

Muir Woods National Monument  
California

US Department of the Interior  
National Park Service



# Muir Woods National Monument Sustainable Access Project

FINAL ENVIRONMENTAL ASSESSMENT



May 2017



# CONTENTS

## CHAPTER 1: PURPOSE OF AND NEED FOR ACTION 1

INTRODUCTION	1
PURPOSE OF THE ACTION	2
NEED FOR THE ACTION	2
OBJECTIVES IN TAKING ACTION	3
PROJECT AREA	3
BACKGROUND	5
Purpose and Significance of Muir Woods National Monument	5
Relationship to Other Plans or Agreements	5
ISSUES AND IMPACT TOPICS	5
IMPACT TOPICS RETAINED FOR FURTHER ANALYSIS	6
Visitor Experience and Safety	6
Transportation	6
Geology and Soils	6
Vegetation	6
Water Resources and Hydrologic Processes	6
Threatened and Endangered Species	7
Cultural Resources	7
Climate Change	8
IMPACT TOPICS CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS	8
Air Quality	8
Environmental Justice	8
Dark Night Skies	9
Indian Trust Resources	9
Indian Sacred Sites	9
Socioeconomics	9
Soundscapes	9
Visual Resources	10
Wildlife and Wildlife Habitat	10

## CHAPTER 2: ALTERNATIVES 11

INTRODUCTION	11
ALTERNATIVE 1: NO ACTION	11
ALTERNATIVE 2: ROADSIDE PARKING, ANNEX LOT EXPANSION, AND SUSTAINABLE ACCESS IMPROVEMENTS	13
ALTERNATIVE 3: NURSERY PARKING AND SUSTAINABLE ACCESS IMPROVEMENTS (PREFERRED ALTERNATIVE)	16
MITIGATION MEASURES	20
General	20
Visitor Experience, Safety, and Transportation	20
Geology and Soils	20
Vegetation	21
Water Resources and Hydrologic Processes	21
Threatened and Endangered Species	22
Cultural Resources	23

## Contents

ALTERNATIVES CONSIDERED AND NOT CARRIED FORWARD	23
Expanded Annex Lot Only	23
Expanded Annex Lot and Nursery Parking	24
Construct a Parking Lot on Panoramic Highway	24
All Visitors Arrive by Shuttle	24
Convert Muir Woods Road to One-Way Travel	24
SUMMARY OF ENVIRONMENTAL CONSEQUENCES	24
<b>CHAPTER 3: AFFECTED ENVIRONMENT</b>	<b>31</b>
INTRODUCTION	31
VISITOR EXPERIENCE AND SAFETY	31
Visitor Experience	31
Visitor Safety	33
TRANSPORTATION	34
Parking	34
Pedestrians	35
Bicycles	36
Privately Owned Vehicles	36
Public Transportation	37
GEOLOGY AND SOILS	37
VEGETATION	40
WATER RESOURCES AND HYDROLOGIC PROCESSES	43
Groundwater	43
Surface Water	43
Wetlands	45
Water Quality	45
Floodplains	47
THREATENED AND ENDANGERED SPECIES	47
Coho Salmon	47
Steelhead Trout	48
Northern Spotted Owl	48
Marbled Murrelet	49
California Red-Legged Frog	49
CULTURAL RESOURCES	49
Area of Potential Effects	49
Properties Listed in the National Register	50
Properties with a Formal Determination of Eligibility for the National Register	50
Archeology	52
Tribal Consultation	52
<b>CHAPTER 4: ENVIRONMENTAL CONSEQUENCES</b>	<b>53</b>
GENERAL METHODOLOGY FOR ESTABLISHING IMPACTS	53
CUMULATIVE IMPACTS ANALYSIS METHODOLOGY	53
Muir Woods Reservation System	53
Muir Woods Road Bridge Replacement Project	54
Muir Woods Road Rehabilitation Project	54
Muir Woods Water and Wastewater Rehabilitation Project	55

Redwood Creek Trail Realignment and Dias Ridge Trail Extension Project	55
Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project	55
VISITOR EXPERIENCE AND SAFETY	55
Methodology and Assumptions	55
Impacts of Alternative 1: No Action	56
Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	58
Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements	60
TRANSPORTATION	61
Methodology and Assumptions	61
Impacts of Alternative 1: No Action	61
Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	63
Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements	65
GEOLOGY AND SOILS	66
Methodology and Assumptions	66
Impacts of Alternative 1: No Action	66
Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	68
Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements	69
VEGETATION	70
Methodology and Assumptions	70
Impacts of Alternative 1: No Action	70
Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	72
Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements	73
WATER RESOURCES AND HYDROLOGIC PROCESSES	74
Methodology and Assumptions	74
Impacts of Alternative 1: No Action	74
Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	77
Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements	78
THREATENED AND ENDANGERED SPECIES	80
Methodology and Assumptions	80
Impacts of Alternative 1: No Action	80
Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	83
Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements	85
CULTURAL RESOURCES	87
Methodology and Assumptions	87
Impacts of Alternative 1: No Action	88
Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	89
Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements	90
<b>CHAPTER 5: CONSULTATION AND COORDINATION</b>	<b>93</b>
PLANNING AND PUBLIC INVOLVEMENT	93
Public Involvement	93
AGENCY CONSULTATION	94
Section 7 of the Endangered Species Act	94
Section 106 of the National Historic Preservation Act	94

**ACRONYMS AND ABBREVIATIONS 97**

**REFERENCES 99**

**LIST OF PREPARERS 107**

**LIST OF FIGURES**

Figure 1. No Available Parking Spaces	2
Figure 2. Shoulder Parking along Muir Woods Road	2
Figure 3. Muir Woods Sustainable Access Project Area	4
Figure 4: Alternative 1: No Action	12
Figure 5: Alternative 2	15
Figure 6: Alternative 3	17
Figure 7. Shoulder Parking near Conlon Lot	35
Figure 8: Soil Types in the Project Area	39
Figure 9: Vegetation Types in the Project Area	41
Figure 10: Surface Water and Forested Wetlands	44
Figure 11: Area of Potential Effects	51
Figure 12. Post Installation and Erosion Control Measures	54

**LIST OF TABLES**

Table 1. Summary of Alternative Elements	18
Table 2. Summary of Environmental Consequences	25
Table 3. Parking within Monument Boundaries	35

**APPENDIXES**

Appendix A—Responses to Comments on the Draft Environmental Assessment	
Appendix B—Consultation Correspondence	



# CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

## INTRODUCTION

The National Park Service (NPS) is proposing to improve visitor access and arrival facilities at Muir Woods National Monument (monument), improve visitor experience and safety, and enhance monument resources. These improvements include redesigning or rehabilitating parking areas, bus or shuttle areas, stormwater management infrastructure, restrooms, trails, and interpretive media. This environmental assessment analyzes the impacts that could result from taking no action and the impacts that could result from two action alternatives.

This environmental assessment has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, and implementing regulations, 40 Code of Federal Regulations (CFR) Parts 1500–1508: *Protection of Environment*, 43 CFR Part 46: *Implementation of the National Environmental Policy Act of 1969*, Director’s Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making* (NPS 2011a) and its accompanying handbook (NPS 2001, 2015a), section 106 of the National Historic Preservation Act of 1966, and section 7, *Interagency Cooperation*, of the Endangered Species Act.

This chapter describes the reasons the National Park Service is taking action. Specifically, this chapter includes the following:

- purpose of, and need for, action
- objectives in taking action
- purpose and significance of the monument
- project area evaluated for impacts
- relationship to other plans or agreements
- discussion of issues and impact topics retained for further analysis
- discussion of issues considered but dismissed from further analysis

The monument consists of approximately 554 acres of land located on the Marin Peninsula, a large and mountainous stretch of land north of San Francisco, in Marin County, California. This area is included in the nine-county region generally referred to as the Bay Area and has a population of more than 7 million. Development is largely restricted to the eastern half of the Marin Peninsula along San Francisco Bay, a region traversed by highways leading north from San Francisco over the Golden Gate Bridge. The monument is approximately 2 miles inland of the Pacific Ocean, 10 miles northwest of the Golden Gate Bridge, and near other protected public lands, such as Point Reyes National Seashore, Mount Tamalpais State Park, and the Marin Municipal Water District.

Visitors traveling to the monument in privately owned vehicles primarily use Muir Woods Road, a winding, two-lane county road that connects on the east with Panoramic Highway and Mill Valley. Frank Valley Road, which connects to State Highway 1 near Muir Beach, provides a secondary access route for privately owned vehicles and is the primary access route for the Muir Woods Shuttle. The entry area to the monument is located roughly in the middle of Muir Woods Road, at the southern end of Redwood Canyon. The entry area contains parking lots, restrooms, and a small visitor center. The monument receives very heavy visitation during the peak season (April through September) and in the off-season on holidays and during periods of good weather. Demand for parking often exceeds the capacity of the monument’s lots during peak visitation, and informal overflow parking occurs on the shoulders of Muir Woods Road (see figures 1 and 2).



SOURCE: NPS

**FIGURE 1. NO AVAILABLE PARKING SPACES**



SOURCE: NPS

**FIGURE 2. SHOULDER PARKING ALONG MUIR WOODS ROAD**

Approximately 1,123,000 people visited the monument in 2016. In response to heavy visitation over several years, the National Park Service has taken steps to manage visitation to ensure a high level of protection of natural and cultural resources and provide a positive and safe visitor experience. These steps included expanding the Muir Woods Shuttle service to promote public transportation, installing and operating changeable message signs on US Route 101 to inform visitors that parking may be unavailable, more actively managing parking areas, and increasing interagency enforcement actions to reduce illegal parking. The National Park Service is in the process of implementing a reservation system to manage motorized vehicle access to the monument and plans to begin operating the system in January 2018. The National Park Service completed an environmental assessment in October 2015 and a finding of no significant impact for the reservation system in December 2015 (NPS 2015b, c). These compliance documents identified the short-, mid-, and long-term visitation and transportation levels for the monument, which are expected to be reduced to approximately 924,400 visitors. This environmental assessment uses the assumptions for visitation, visitor flow, and transportation capacity from those documents.

## **PURPOSE OF THE ACTION**

The purpose of this action is to improve visitor experience and safety by providing appropriate infrastructure, promote the restoration of natural resources and processes, and preserve cultural resources.

## **NEED FOR THE ACTION**

The project is needed to address deferred maintenance and improve the design and placement of parking areas and visitor amenities and to resolve long-standing problems with traffic congestion that detracts from visitor experience, creates the potential for safety concerns, and negatively affects stormwater management and water quality in the Redwood Creek Watershed. The transportation system dates to the 1960s when standards for environmental protection differed from current standards. Currently, some visitors encounter a lack of pedestrian walkways in areas frequented by tour buses, shuttles, and privately owned vehicles. Additionally, the National Park Service needs to update existing stormwater management infrastructure in the project area to implement best management practices and comply with federal law, policy, and regulation.



## OBJECTIVES IN TAKING ACTION

All of the action alternatives selected for detailed analysis must meet specific project objectives, supporting the purpose of, and need for, action. The following objectives are grounded in the purpose of, and need for, action, as well as the monument's enabling legislation and vision described in the *Golden Gate National Recreation Area and Muir Woods National Monument General Management Plan / Environmental Impact Statement* (NPS 2014a).

- Visitor Experience and Safety
  - Provide safe and accessible pedestrian routes from all parking areas to the Entry Plaza and connecting trails, incorporating opportunities for education and interpretation.
  - Provide visitor amenities closer to all parking areas.
  - Meet accessibility standards required under the Architectural Barriers Act (ABA) of 1968.
- Transportation
  - Reconfigure parking areas to improve operational efficiency and provide sufficient parking capacity for privately owned vehicles (no more than 232 spaces) as approved in the *Muir Woods National Monument Reservation System Finding of No Significant Impact* (NPS 2015c).
  - Provide sufficient capacity for buses, shuttles, and authorized commercial use vehicles to drop-off and pick-up passengers, as approved in the *Muir Woods National Monument Reservation System Finding of No Significant Impact* (NPS 2015c).
  - Reduce vehicle and pedestrian conflicts in all parking and transit areas.
- Natural Resources
  - Protect water quality in the Redwood Creek Watershed by improving stormwater and wastewater management infrastructure in the project area.
  - Design infrastructure improvements in a manner that anticipates and encourages future restoration or enhancement projects for plant and animal communities in the watershed.
- Cultural Resources
  - Protect the fundamental resources that contribute to the national significance of the monument.
  - Design infrastructure improvements to be compatible with the Muir Woods cultural landscape and minimize impacts on the property listed in the National Register of Historic Places (national register).
  - Preserve and protect cultural resources to highlight the interpretive and educational values and provide, wherever possible, access to these resources.

## PROJECT AREA

The area of analysis is the entry area of Muir Woods National Monument, as shown in figure 3. This area consists of approximately 17 acres of land and water. The majority of proposed actions would occur in the Entry Plaza, parking lots or other developed areas, trails, and at the Dipsea Trail crossing over Redwood Creek.

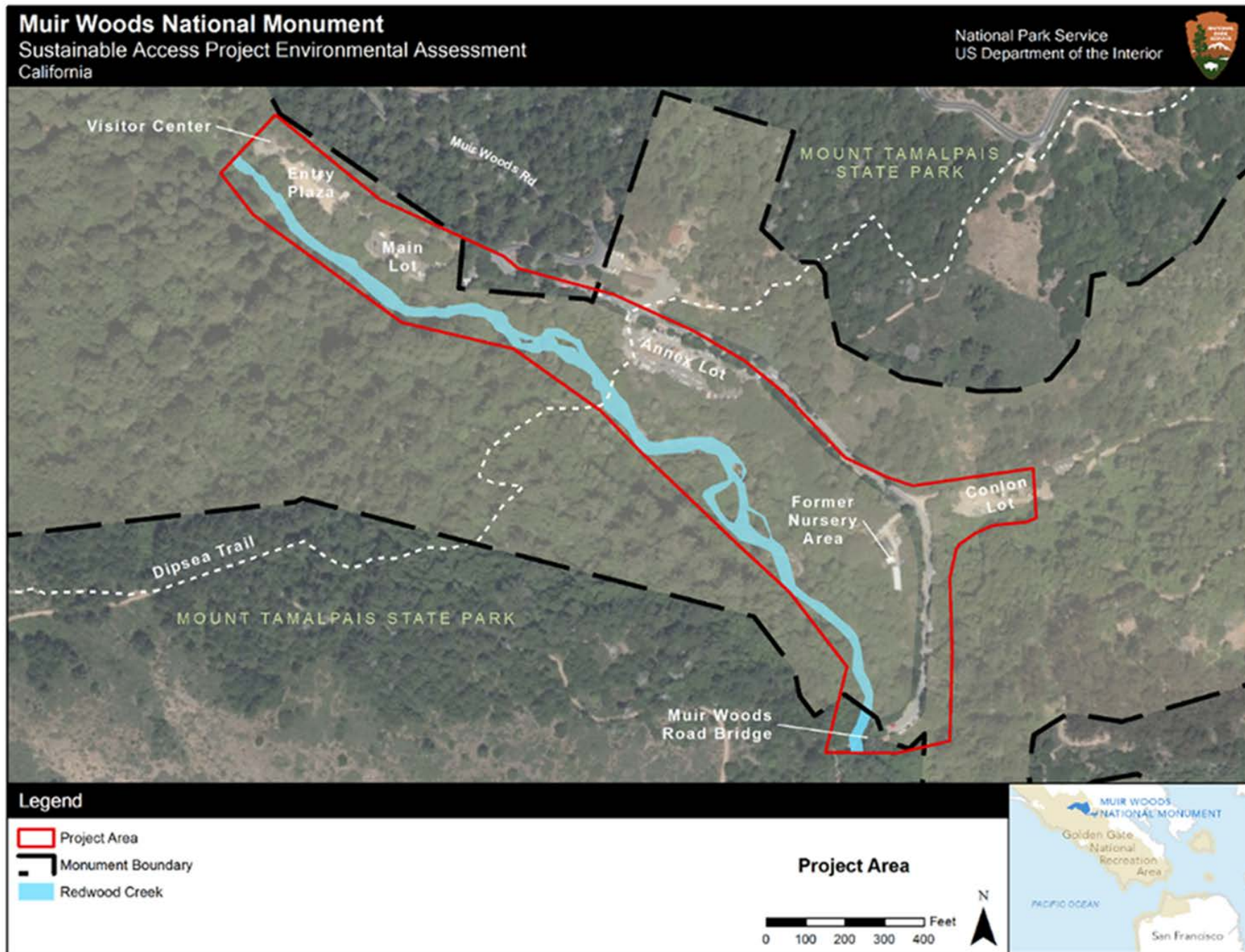


FIGURE 3. MUIR WOODS SUSTAINABLE ACCESS PROJECT AREA

## BACKGROUND

### Purpose and Significance of Muir Woods National Monument

The purpose of the monument is to preserve the primeval character and ecological integrity of the old-growth redwood forest for its scientific value and inspiration (NPS 2014a). The monument preserves the last remnant of old-growth redwood forest near metropolitan San Francisco. The establishment of the monument is also an important demonstration of early 20th century conservation history and continues to inspire stewardship actions today (NPS 2014a).

### Relationship to Other Plans or Agreements

Two NPS documents relate to this environmental assessment. The *Record of Decision for the Golden Gate National Recreation Area and Muir Woods National Monument Final General Management Plan / Environmental Impact Statement* provides comprehensive direction for resource preservation and visitor use and a foundation for decision making for Golden Gate National Recreation Area and Muir Woods National Monument for the next 20 years (NPS 2015e). The plan prescribes the resource conditions and visitor experiences to be achieved and maintained over time. A review of the purpose, significance, and special mandates for the park and monument clarifies relevant law and policy requirements.

The *Muir Woods National Monument Reservation System*, approved December 2015, focuses on improving the visitor experience at the monument. The reservation system will reduce peak visitation at the monument by managing motorized vehicle access and allowing the NPS staff to control parking both within the monument's lots and on Muir Woods Road (owned and managed by Marin County). In accordance with a memorandum of understanding between the National Park Service and Marin County and the *Finding of No Significant Impact* for the reservation system, the project will also ensure that parking on Muir Woods Road will be eliminated in phases south of the Muir Woods Road Bridge (NPS 2015c, d). Both the reservation system and the memorandum of understanding were informed through public involvement.

## ISSUES AND IMPACT TOPICS

NEPA regulations require an “early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action” (40 CFR Part 1501.7). An issue describes the relationship between actions and environmental resources. Issues are usually problems that either the no-action alternative or current situation has caused or that any of the proposed action alternatives might cause. They also may be questions, concerns, problems, or other relationships, including beneficial ones.

Impact topics are resources or values analyzed for each of the alternatives and are discussed because issues have been identified. During internal scoping, NPS staff identified potential issues that could result from implementation of the action alternatives. Resources or values that could be affected include visitor use and experience; transportation; geology and soils; vegetation; water quality; threatened and endangered species; cultural resources; and climate change. The impact topics identified during scoping are discussed in detail in “Chapter 3: Affected Environment” and are analyzed in “Chapter 4: Environmental Consequences.”

## **IMPACT TOPICS RETAINED FOR FURTHER ANALYSIS**

### **Visitor Experience and Safety**

According to Title 54 of the United States Code (USC), providing for visitor enjoyment is one of the basic purposes of the National Park Service (54 USC 100101(a)). Reconfiguring parking within the monument would reduce vehicular congestion and improve visitor safety and enhance the visitor experience. Pedestrian paths are poorly located and in poor condition, and the parking and arrival experience is disjointed and confusing. The restroom in the Entry Plaza is undersized and does not accommodate current levels of visitation. Because each alternative could affect visitor experience and safety by changing wayfinding, arrival sequencing, pedestrian and traffic management, and through construction activities, this impact topic is carried forward for detailed analysis.

### **Transportation**

NPS *Management Policies 2006* state: “depending on a park unit’s size, location, resources, and level of use, the Service will, where appropriate, emphasize and encourage alternative transportation systems [and] park roads will be well constructed, sensitive to natural and cultural resources, reflect the highest principles of park design, and enhance the visitor experience” (NPS 2006). The reservation system is expected to reduce daily vehicle trips throughout the year (most notably in July and August), reduce peak-hour vehicle trips by more than one-third throughout the year (more than one-half in July and August), and reduce shoulder parking on Muir Woods Road. Both action alternatives could affect transportation at the monument by changing arrival sequencing and traffic management. Additionally, construction activities could affect local transportation for a short time. Therefore, this impact topic is carried forward for detailed analysis.

### **Geology and Soils**

NPS *Management Policies 2006* state: the “Service will actively seek to understand and preserve the soil resources of parks, and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil or its contamination of other resources” (NPS 2006). Reduced shoulder parking would minimize areas contributing to surface runoff and erosion along Muir Woods Road. However, the potential for surface runoff and soil compaction from new impervious surfaces and the short-term use of construction equipment would still be present. Therefore, this impact topic is carried forward for detailed analysis.

### **Vegetation**

NPS *Management Policies 2006* states that the agency will strive to maintain all components and processes of naturally evolving monument ecosystems, including the natural abundance, diversity, and ecological integrity of plants (NPS 2006). Reducing shoulder parking along Muir Woods Road would allow regrowth of native vegetation along the shoulder. However, vegetation in the new or expanded parking lots would be permanently removed, and adjacent riparian vegetation would be temporarily affected. In addition, the establishment of invasive, nonnative plants and changes in the shade regime could indirectly affect additional acreage near the project area. Therefore, this impact topic is carried forward for detailed analysis.

### **Water Resources and Hydrologic Processes**

The Clean Water Act was enacted to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters” (33 USC 1251 et seq.). Consideration of impacts on wetlands is also

required under Executive Order 11990, “Protection of Wetlands,” and NPS Director’s Order 77-1: *Wetland Protection* (NPS 2002). Executive Order 11988, “Floodplain Management,” requires an examination of impacts on floodplains and potential risk involved in placing facilities in floodplains. NPS *Management Policies 2006* and Director’s Order 77-2: *Floodplain Management* (NPS 2003) provide guidelines for proposals in floodplains.

A statement of findings separate from this environmental assessment would not be required for wetlands because of exceptions under sections 4.2.1a and 4.2.1d of Director’s Order 77-1. The Sustainable Access Project would not affect floodplain processes and values; therefore, the project is exempt under section 5b of Director’s Order 77-2. However, the National Park Service prepared a *Floodplain Statement of Findings* in accordance with Director’s Order 77-2 and approved the findings in the *Record of Decision* for the *Golden Gate National Recreation Area and Muir Woods National Monument Final General Management Plan / Environmental Impact Statement* (NPS 2015e). The *Floodplain Statement of Findings* addressed existing and proposed facilities and structures presumed to be in or adjacent to the monument’s floodplain.

The Sustainable Access Project would reduce shoulder parking to lower the degree of surface runoff along Muir Woods Road. However, the construction of parking areas and trails could affect hydrology near waters of the United States, requiring appropriate mitigation measures. Furthermore, construction activities could have a short-term impact on sedimentation. Therefore, this impact topic is carried forward for detailed analysis.

## Threatened and Endangered Species

Section 7 of the Endangered Species Act requires all federal agencies to consult with the US Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats (16 USC 1531 et seq.). The construction of new parking lots would permanently remove vegetation and could contribute to surface runoff into Redwood Creek, possibly affecting some sensitive species. The National Park Service retrieved a list of species present at the monument from the USFWS Information for Planning and Conservation webpage. The list allowed the National Park Service to determine that coho salmon (*Oncorhynchus kisutch*), steelhead trout (*Oncorhynchus mykiss*), northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus*), and the California red-legged frog (*Rana draytonii*) may be affected as a result of this project. In addition, the project area contains critical habitat for coho salmon and steelhead trout. A separate biological assessment has been prepared to analyze impacts on these species and to fulfill section 7 requirements under the Endangered Species Act. This impact topic is carried forward for detailed analysis because of the potential presence of these species and the presence of critical habitat in the project area.

## Cultural Resources

Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470 et seq.), and its implementing regulations under 36 CFR Part 800 require all federal agencies to consider effects of federal actions on historic properties, including historic structures eligible for or listed in the national register. The project area, which is outside the Muir Woods Historic District, has been surveyed for archeological resources (Gavette 2016). Although the National Park Service would avoid impacts on known archeological sites, it would design new structures to follow the Secretary of the Interior’s *Standards for the Treatment of Historic Properties* (NPS 1995), and National Park Service staff would monitor areas of archeological sensitivity. If archeological resources are identified during construction, the National Park Service would consult with the State Historic



Preservation Office in accordance with federal legislation and regulations and NPS policy. Therefore, this impact topic is carried forward for detailed analysis.

## **Climate Change**

The 2012 NPS *Climate Change Action Plan 2012–2014* (NPS 2012a) and 2016 Council on Environmental Quality's (CEQ) *Final Guidance for Federal Departments and Agencies on the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (CEQ 2016) both recommend that federal agencies consider the extent to which a proposed action and its reasonable alternatives contribute to climate change through greenhouse gas emissions and take into account the ways in which a changing climate over the life of the project may alter the overall environmental implications of such actions. The effects of climate change can result in increased stress to natural systems. Within California, anticipated climate change impacts to note with regard to this environmental assessment include the increase of drought, wildfires, flooding, tree-related disease and loss of native fish, wildlife, and vegetation. Potential changes to monument resources associated with climate change are discussed in "Chapter 3: Affected Environment" on a case-by-case basis as appropriate within each retained impact topic.

## **IMPACT TOPICS CONSIDERED BUT DISMISSED FROM FURTHER ANALYSIS**

In accordance with CEQ regulations 1500.1(b) and the *NEPA Handbook* (NPS 2015a), the National Park Service determines whether impact topics are evaluated in detail or dismissed from further evaluation to concentrate on the issues of concern. This section provides an evaluation and explanation as to why the National Park Service dismissed the following impact topics from further consideration. Impact topics are dismissed from further evaluation if they:

- do not exist in the project area
- would not be affected by the alternatives or the likelihood of impacts are not reasonably expected
- would result in impacts that, through the application of mitigation measures, would be minimal, and
- there is little controversy on the subject or few reasons to otherwise include the topic

## **Air Quality**

Section 118 of the Clean Air Act requires the National Park Service to meet all federal, state, and local air pollution standards (42 USC 7401 et seq.). The project would not increase vehicle trips to the monument, and all alternatives include the same number of available parking spaces. Either action alternative would result in localized emissions and fugitive dust at the monument during construction activities; however, emissions and fugitive dust would occur only during the construction period and would dissipate quickly. No long-term impacts on air quality are expected. Furthermore, air quality data recorded between 2004 and 2013 has shown improved conditions at the monument. Therefore, the topic was dismissed from further analysis in this document.

## **Environmental Justice**

Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-income Populations," requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. Disproportionate health or environmental effects on minorities or low-income

populations or communities as defined in the US Environmental Protection Agency's *Environmental Justice Guidance* (1998) would not occur from the construction activities under the action alternatives. Therefore, this topic was dismissed from further analysis in this document.

## **Dark Night Skies**

In accordance with NPS *Management Policies 2006*, the National Park Service strives to preserve dark night skies and will “minimize light that emanates from park facilities, and also seek the cooperation of park visitors, neighbors, and local government agencies to prevent or minimize the intrusion of artificial light into the night scene of the ecosystems of parks” (NPS 2006). No construction activities would occur at night, and no permanent area lighting or lamp posts of any kind would be installed. Therefore, the topic was dismissed from further analysis in this document.

## **Indian Trust Resources**

In accordance with the Environmental Compliance Memorandum 97-2 by the US Department of the Interior, the National Park Service must ensure that it explicitly addresses any anticipated effects on Indian trust resources in an environmental compliance document. If any effects are identified, the National Park Service must consult with the affected tribe(s) on a government-to-government basis with respect to the impact from the proposed action. However, if the project or action is expected to have either an insignificant impact or no impact on any Indian trust resources, the environmental compliance document must state the reason for dismissal. Since no Indian trust resources exist in the project area, the topic was dismissed from further analysis in this document (NPS, Terzis, pers. comm. 2016a).

## **Indian Sacred Sites**

In accordance with Executive Order 13007, the National Park Service must accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites. Continued access to, and use of, these sites is often essential to the survival of family, community, or regional cultural systems, including patterns of belief and sociocultural and religious life. However, no Indian sacred sites are found in the project area (NPS, Terzis, pers. comm. 2016a). Therefore, the topic was dismissed from further analysis in this document.

## **Socioeconomics**

Construction activities associated with the action alternatives would not adversely affect local businesses or other agencies. However, a decision to make sustainable access improvements would provide beneficial impacts on the local economy because of minor increases in employment for the construction workforce and revenues for the businesses engaged in the construction process. Any increase in workforce and revenue, however, would be temporary, lasting only as long as construction. Because the impact on the socioeconomic environment would be minimal, this topic was dismissed from further analysis in this document.

## **Soundscapes**

In accordance with the NPS *Management Policies 2006* and Director's Order 47: *Sound Preservation and Noise Management* (NPS 2000), an important component of the NPS mission is the preservation of the natural soundscape associated with national monument units. The development of parking lots would occur along the existing road system where sounds from vehicular traffic and other

human activities are common. During construction, anthropogenic noise would likely increase because of construction activities, equipment, vehicular traffic, and crews. Any sounds generated from construction would be temporary, lasting only as long as the construction activity is generating the sounds, and would have no long-term, measureable effect on visitors, employees, or natural soundscape conditions; therefore, the topic was dismissed from further analysis in this document.

## **Visual Resources**

The NPS *Management Policies 2006* state that the monument's scenery and scenic features are included among the resources and values to be protected and conserved unimpaired for enjoyment by current and future generations. Visual impacts from construction activities would be short term and localized. Expanded or new parking lots would become permanent features on the landscape, potentially detracting from the scenic resources of the monument, and affecting visual quality. However, the parking lots would concentrate vehicles within existing lots and limit them to specific areas where they would be screened by incorporating native vegetation, effectively reducing visual impacts. Therefore, this topic was dismissed from further analysis in this document.

## **Wildlife and Wildlife Habitat**

According to the NPS *Management Policies 2006*, the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of native animal populations. Parking areas are known to have numerous direct and indirect impacts on wildlife, including direct injury and mortality from vehicle collisions, altered behavior and patterns of habitat use, and increased human use and disturbance of wildlife (Forman and Alexander 1998; Trombulak and Frissell 2000; Gerow et al. 2010). Increased noise levels during the construction phase of this project could also result in temporary increases in localized disturbances to wildlife. While the action alternatives could result in minimal, temporary impacts, they would not affect the viability or population dynamics of wildlife at the monument. Therefore, the topic was dismissed from further analysis in this document.

## **CHAPTER 2: ALTERNATIVES**

### **INTRODUCTION**

This chapter describes alternatives for improving the entry area of the monument, consistent with the purpose of, and need for, action. The planning team at the monument and Golden Gate National Recreation Area developed alternatives that address issues with sustainable infrastructure, operations, and management of both visitor facilities and vehicular traffic. The planning team consulted representatives from Marin County, the California Department of Parks and Recreation, California State Historic Preservation Office, National Marine Fisheries Service, and the US Fish and Wildlife Service and considered the feedback received during the public scoping process. Please see “Chapter 5: Consultation and Coordination” for more information.

The environmental assessment includes three alternatives: the no-action alternative and two action alternatives. The action alternatives present a range of reasonable and feasible approaches that meet the purpose of, and need for, action. This chapter also discusses alternatives that were initially considered but not carried forward for detailed analysis, identifies the NPS preferred alternative, and lists mitigation measures for the alternatives. These elements are represented graphically in the figures for each alternative (i.e., figure 4 for alternative 1, figure 5 for alternative 2, and figure 6 for alternative 3).

### **ALTERNATIVE 1: NO ACTION**

The no-action alternative describes the current management and existing conditions of the entry area. The no-action alternative provides a basis for comparing the management direction and environmental consequences of the action alternatives.

Under the no-action alternative, the National Park Service would maintain the existing 232 parking spaces for privately owned vehicles and 16 parking spaces for buses, shuttles, and commercial use vehicles and would not make sustainable access improvements to infrastructure at the monument. The Entry Plaza currently contains 9 parking spaces for visitors with disabilities (ABA-compliant) and 2 spaces for privately owned vehicles. The Main Lot contains 27 parking spaces for privately owned vehicles and 16 parking spaces for buses, shuttles, and commercial use vehicles and provides passenger drop-off. The Annex Lot contains 114 parking spaces, and the Conlon Lot contains 49 parking spaces for privately owned vehicles. Existing roadside parking for 31 privately owned vehicles would remain on the east side of Muir Woods Road between Conlon Avenue and the Muir Woods Road Bridge.

The restroom between the Entry Plaza and the Main Lot near Redwood Creek would remain in its existing location. Visitors who park in the Annex Lot and Conlon Lot or beside Muir Woods Road would continue to use the pedestrian trail adjacent to the road to reach the Entry Plaza. The wooden plank over Redwood Creek along the Dipsea Trail would be used seasonally as a dry season crossing over the creek. Existing culverts would remain in place, and no engineered stormwater management infrastructure would be constructed in the project area. The two lift stations located in the former Nursery Area and northeast of the Conlon Lot would also remain in place.

Visitors would continue to have access to interpretive and educational opportunities through brochures and exhibits available at the visitor center; taking self-guided walks; and attending talks, tours, and programs led by monument staff or in collaboration with local organizations. Figure 4 shows the existing parking and site infrastructure at the monument.

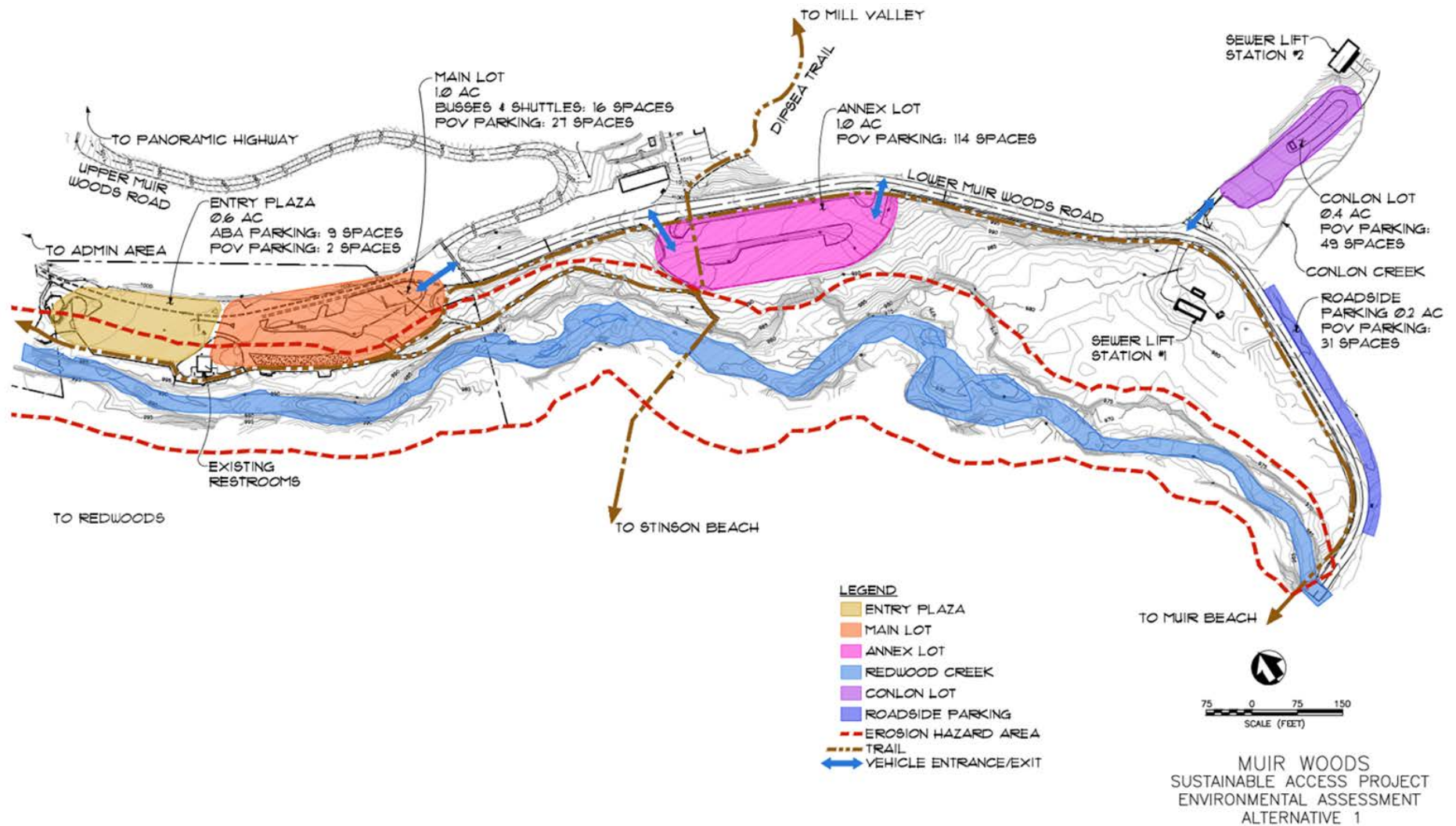


FIGURE 4: ALTERNATIVE 1: NO ACTION



## **ALTERNATIVE 2: ROADSIDE PARKING, ANNEX LOT EXPANSION, AND SUSTAINABLE ACCESS IMPROVEMENTS**

Under alternative 2, the National Park Service would modify the configuration of the Entry Plaza, Main Lot, Annex Lot, and Conlon Lot but would maintain the same number of parking spaces for privately owned vehicles as the no-action alternative (232). The National Park Service would remove all parking from the Entry Plaza, although administrative vehicular access would remain, and would rehabilitate approximately 0.4 acre of the plaza with native riparian vegetation.

Parking for visitors with disabilities would be relocated to the Main Lot, with 11 available spaces. The Main Lot would maintain its existing footprint but would be restriped to meet ABA-parking requirements and provide 18 parking spaces for buses, shuttles, and commercial use vehicles.

The Annex Lot would be reconfigured to contain 143 parking spaces for privately owned vehicles. To accommodate 29 new spaces, the National Park Service would expand the lot to the southeast, requiring 0.2 acre of development and restriping. Fill material would be required to level the expansion area, which slopes downhill. Two new culverts would be installed during expansion to accommodate existing drainages on site. Impervious asphalt would be used to surface the Annex Lot, and the lot would be designed with one-way aisles and a single entry and exit at its southern end to promote efficient vehicular circulation.

The Conlon Lot would be widened 6 to 8 feet to accommodate a two-way driveway and 48 parking spaces for privately owned vehicles. Visitors parking in the Conlon Lot would access Muir Woods Road via a newly developed pedestrian trail beside Conlon Creek. Some utility poles and electrical lines in the lot would be relocated as a result of expansion.

Existing roadside parking would remain on the east side of Muir Woods Road between Conlon Avenue and the Muir Woods Road Bridge and would contain 30 parking spaces for privately owned vehicles. The roadside parking area would be paved and striped.

Engineered stormwater management infrastructure would be used to treat the runoff from the Entry Plaza and all parking lots. Shallow excavated ditches lined with filter strip sand and topped with stone to form a subsurface basin, where water is stored until it infiltrates into the soil, would be used to treat stormwater. This system is commonly known as an infiltration trench. These trenches greatly reduce the volume of runoff and are particularly good for groundwater recharge because they allow a significant amount of rainwater to infiltrate (USEPA 2008). This technique is considered to be very effective when used in conjunction with a pre-treatment technique such as a vegetated buffer strip to capture sediment particles. Discharge from this infrastructure would meet the applicable water quality standards, such as those found in the *Bay Area Stormwater Management Agencies Association Post-Construction Manual*, and would not require additional treatment (BASMAA 2014).

Visitors parking in the Conlon Lot or along the designated roadside area would cross Muir Woods Road at the Conlon Avenue intersection by way of a delineated crosswalk. The existing Muir Woods Road pedestrian trail would remain the primary route to the Dipsea Trail and the Entry Plaza (similar to the no-action alternative).

The portion of the Dipsea Trail passing through the Annex Lot would be realigned to the northwest perimeter of the lot. Additional signs directing visitors to the Entry Plaza and local trails would be installed as a means to improve wayfinding at the monument. A new pedestrian footbridge would be installed at the Redwood Creek crossing near the location of the existing wooden plank, but placed roughly 14 feet above the creekbed to match the grade of the Annex Lot.

Under alternative 2, the existing restrooms near Redwood Creek in the Entry Plaza would be relocated outside the erosion hazard area. The relocated restrooms would not impede administrative vehicular access to the Entry Plaza. Additional restrooms would be constructed near the former Nursery Area to accommodate visitors parking at the southern end of the project area and would be visible from the Conlon Lot. The restrooms would be sized to accommodate peak season visitation levels, as approved in the *Muir Woods National Monument Reservation System Finding of No Significant Impact* (NPS 2015c). Final placement of the restrooms would be determined during the design phase of the project. The existing structures in the former Nursery Area would be removed, and portions of the area would be revegetated with plants native to the monument. The two lift stations in the former Nursery Area and northeast of the Conlon Lot would remain in place.

The Entry Plaza would be furnished with new interpretive media telling the story of natural, historic, and cultural resource stewardship at the monument. The segment of trail between the Main Lot and Annex Lot would also be furnished with interpretive media. Figure 5 shows the changes that would occur under alternative 2.

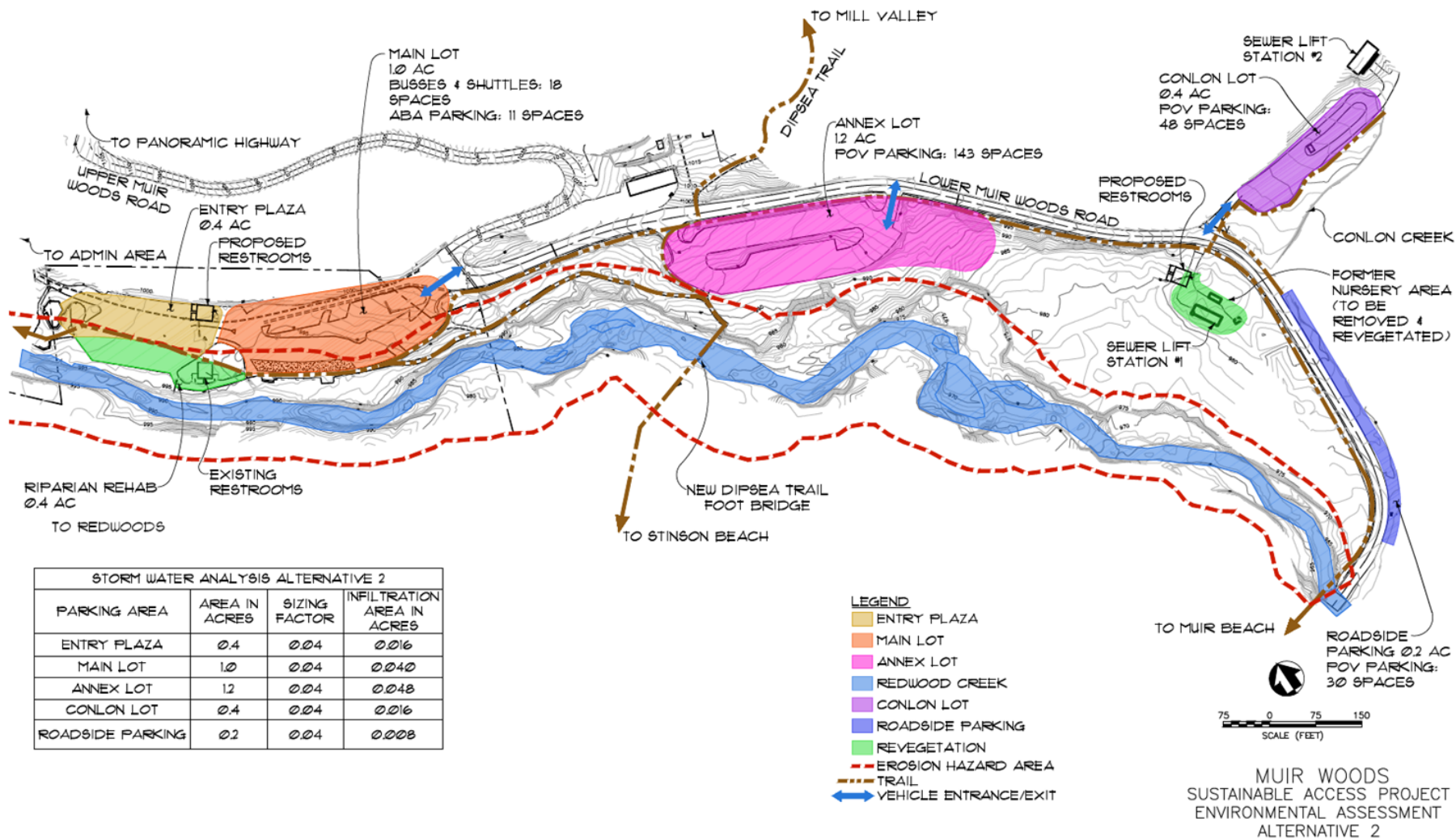


FIGURE 5: ALTERNATIVE 2

### **ALTERNATIVE 3: NURSERY PARKING AND SUSTAINABLE ACCESS IMPROVEMENTS (PREFERRED ALTERNATIVE)**

Alternative 3 is the NPS proposed action and has been identified as the preferred alternative. Alternative 3 would modify the Entry Plaza, Main Lot, Annex Lot, Conlon Lot, and the former Nursery Area but would maintain the same number of parking spaces for privately owned vehicles as the no-action alternative (232). Improvements made in the Entry Plaza, Main Lot, Conlon Lot, to the Entry Plaza restrooms and stormwater management infrastructure, and along the Dipsea Trail would be the same as those described for alternative 2. However, existing roadside parking would be eliminated on the east side of Muir Woods Road between Conlon Avenue and the Muir Woods Road Bridge, and the area would be revegetated with plants native to the monument.

The Annex Lot would be re-graded, reconfigured, and restriped to accommodate 11 new spaces for a total of 125 parking spaces for privately owned vehicles. The lot would be designed with one-way aisles and a single entry and exit at its southern end to promote efficient vehicular circulation.

The two lift stations located in the former Nursery Area and northeast of the Conlon Lot would be replaced with a single, modern 25,000-gallon lift station located near the former Nursery Area. The replacement lift station would be more efficient than the existing units because it would eliminate the need for double pumping wastewater. An underground power line and force main line would be installed to connect the new lift station to the existing sewer line beside the Conlon Lot. The new lift station would be designed to accommodate a new restroom. The decommissioned lift station and structures in the former Nursery Area would be removed; the area would require less than 0.4 acre of development. The decommissioned lift station in the Conlon Lot would be used for storage.

The former Nursery Area would be developed into a parking lot with 48 parking spaces for privately owned vehicles. Minimal filling and grading would be necessary to construct the Nursery Lot because the area is already disturbed. One culvert would be installed during construction to accommodate an existing drainage on site. Impervious asphalt would be used to surface the Nursery Lot, and the lot would be designed with one entrance, one exit, and a single driveway.

The segment of existing pedestrian trail along Muir Woods Road between the Main and Nursery Lots would be decommissioned and revegetated with plants native to the monument. A new woodland pedestrian trail between the Annex and Nursery Lots would be developed. Approximately 1,200 linear feet of disturbance would be required to construct a 6- to 8-foot-wide trail. The trail would pass along the southern edge of the Annex and Nursery Lots, tie into the Dipsea Trail and Entry Plaza, and contain new interpretive media. The trail may need to be built on fill along the perimeter of the Annex and Nursery Lots if it cannot be developed within their respective footprints. To minimize disturbance, low retaining walls may be constructed and small footbridges built over intermittent drainages along the trail route. The trail would meet all applicable accessibility standards. The final segment of this trail between the Main and Annex Lots would be widened to a maximum of 10 to 12 feet with boardwalks over existing drainages.

Figure 6 shows the changes that would occur under alternative 3. Table 1 contains a summary of alternative elements.

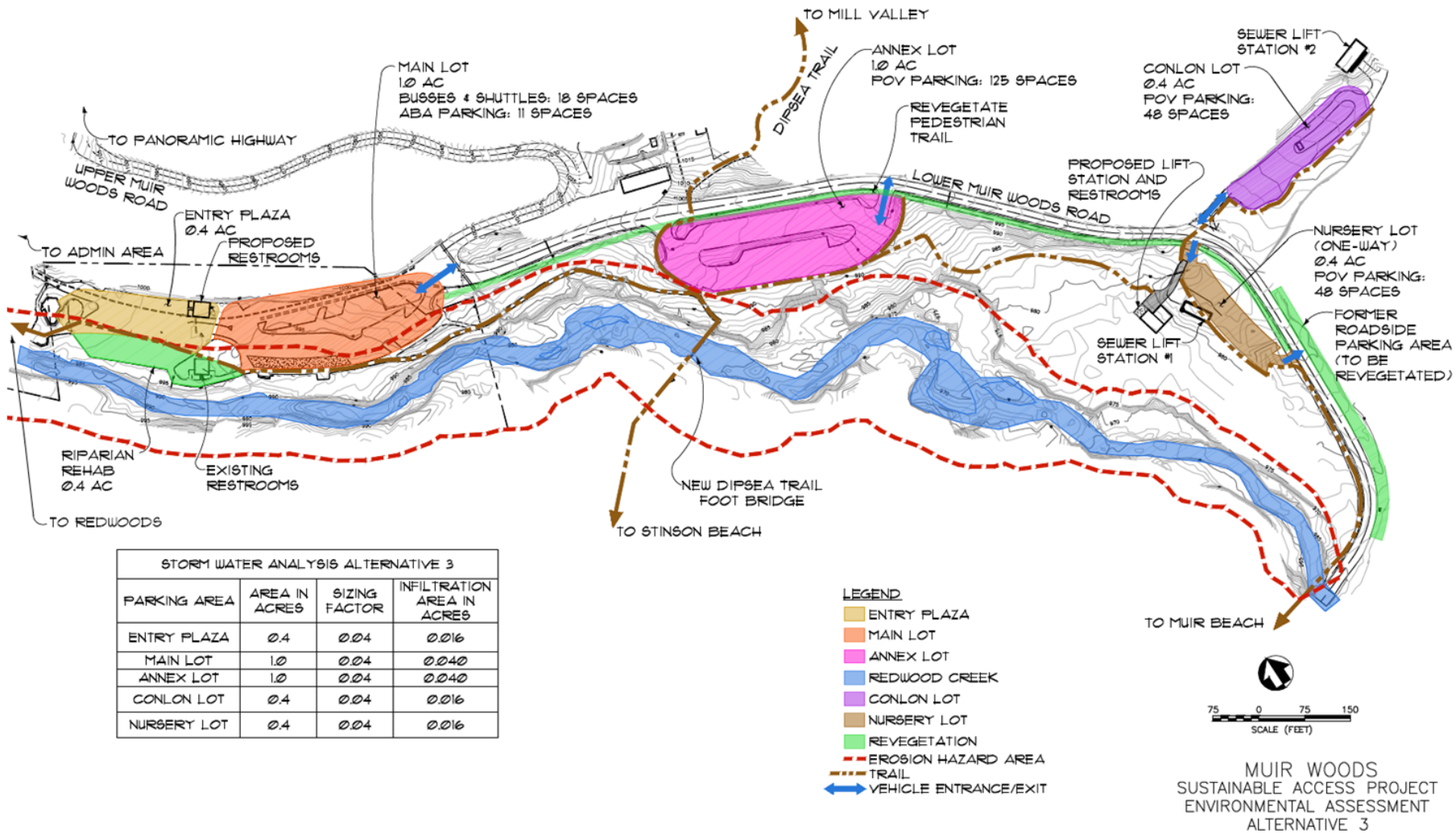


FIGURE 6: ALTERNATIVE 3



**TABLE 1. SUMMARY OF ALTERNATIVE ELEMENTS**

Element	Alternative 1: No-Action	Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	Alternative 3: Nursery Parking and Sustainable Access Improvements
<b>Parking lots and locations</b>	No changes to number, location, or design of parking lots for privately owned vehicles (POV) (232 spaces):  Entry Plaza – 9 Architectural Barriers Act (ABA) compliant, 2 POV  Main Lot – 27 POV  Annex Lot – 114 POV  Conlon Lot – 49 POV  Roadside Parking – 31 POV	Redistribute and design POV parking, to be located as follows (232 spaces):  Entry Plaza – 0  Main Lot – 11 ABA compliant  Annex Lot – 143 POV  Conlon Lot – 48 POV  Roadside Parking – 30 POV	Redistribute and design POV parking, to be located as follows (232 spaces):  Entry Plaza – 0  Main Lot – 11 ABA compliant  Annex Lot – 125 POV  Conlon Lot – 48 POV  Nursery Lot – 48 POV  Roadside Parking – 0 POV
<b>Accommodate buses, shuttles, and commercial use vehicles</b>	No changes to bus, shuttle, and commercial use vehicle accommodation. The Main Lot would continue to accommodate spaces for 16 buses, shuttles, and commercial use vehicles, and 27 POV spaces.	Eighteen parking spaces available for buses, shuttles, and commercial use vehicles in the Main Lot. Remove general POV spaces from the Main Lot.	Same as alternative 2.
<b>Accommodate Architectural Barriers Act (ABA)-compliant parking</b>	No changes to ABA-compliant parking. The Entry Plaza would continue to accommodate nine ABA parking spaces.	Move ABA-compliant parking to the Main Lot, with 11 available ABA parking spaces.	Same as alternative 2.
<b>Develop trail access between parking lots and Entry Plaza</b>	No changes to existing trail access.	Same as alternative 1.	Develop a new woodland pedestrian trail between the Nursery Lot and Annex Lot. Establish small footbridges over intermittent drainages along the trail route. Widen the final portion of this trail between the Main and Annex Lots to a maximum of 10 to 12 feet and include a boardwalk over existing drainages. Decommission the Muir Woods Road pedestrian trail between the Nursery and Main Lots.

**TABLE 1. SUMMARY OF ALTERNATIVE ELEMENTS – CONTINUED**

<b>Element</b>	<b>Alternative 1: No-Action</b>	<b>Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements</b>	<b>Alternative 3: Nursery Parking and Sustainable Access Improvements</b>
<b>Realign Dipsea Trail and construct footbridge over Redwood Creek</b>	No changes to the Dipsea Trail. No changes to existing access over Redwood Creek.	Realign the Dipsea Trail alignment near the Annex Lot. Construct a new footbridge over Redwood Creek.	Same as alternative 2.
<b>Relocate restroom in the Entry Plaza</b>	No changes to existing restroom in the Entry Plaza.	Remove the restroom from the Redwood Creek erosion hazard area in the Entry Plaza. Relocate the restroom within the Entry Plaza.	Same as alternative 2.
<b>Construct a new restroom near the former Nursery Area</b>	No new restroom would be constructed near the former Nursery Area.	Construct a new restroom near the former Nursery Area.	Same as alternative 2.
<b>Construct lift station near the former Nursery Area</b>	No new lift station would be constructed near the former Nursery Area.	Same as alternative 1.	Construct a single modern lift station and underground power and force main lines near the former Nursery Area to replace the two existing lift stations.
<b>Rehabilitate the Redwood Creek erosion hazard area of the Entry Plaza</b>	No rehabilitation would occur in the Entry Plaza.	Rehabilitate the area of the Entry Plaza in the erosion hazard area with native riparian vegetation.	Same as alternative 2.
<b>Revegetate disturbed areas</b>	No improvements would be made under this alternative; therefore, revegetation in disturbed areas would not be necessary.	Revegetate portions of the former Nursery Area with native plant species.	Revegetate roadside parking areas and the Muir Woods Road pedestrian trail with native plant species.
<b>Upgrade stormwater management infrastructure</b>	No improvements would be made under this alternative; therefore, no major upgrades to stormwater management infrastructure would be made.	Install two new culverts during the Annex Lot expansion to accommodate existing drainages on-site. Construct stormwater management infrastructure to treat runoff from all parking lots.	Install one culvert in the former Nursery Area to accommodate an existing drainage on site. Construct stormwater management infrastructure to treat runoff from all parking lots.
<b>Provide additional wayfinding signs and interpretive media</b>	No additional wayfinding or interpretive media would be provided.	Provide additional signs directing visitors to the Entry Plaza and trails. Add new interpretive media in the Entry Plaza and along trails.	Same as alternative 2, plus add interpretive media along new woodland pedestrian trail between the Annex and Nursery Lots.

## **MITIGATION MEASURES**

The National Park Service places strong emphasis on avoiding, minimizing, and mitigating potentially adverse environmental impacts. To help ensure the protection of natural and cultural resources and the quality of the visitor experience, the National Park Service would implement the following measures and best management practices as part of the action alternatives.

### **General**

- Clearly state all resource protection measures in the construction specifications and instruct workers to avoid conducting activities outside the project area. Limit disturbances to roadsides, culvert areas, and other areas inside the project area.
- Hold a preconstruction meeting to inform contractors about sensitive areas, including natural and cultural resources.
- Delineate construction zones outside existing disturbed areas with flagging and confine all surface disturbance to the construction zone.
- Site staging and storage areas for construction vehicles, equipment, materials, and soils in previously disturbed or paved areas approved by the National Park Service. These areas would be outside high visitor use areas and clearly identified in advance of construction.
- Require contractors to properly maintain construction equipment to minimize noise and do not allow construction vehicle engines to idle for extended periods.
- Remove all tools, equipment, barricades, signs, and surplus materials from the project area upon completion of the project.

### **Visitor Experience, Safety, and Transportation**

- Inform visitors in advance of construction activities via a number of outlets, including the monument's website, various signs, the visitor center, and bus and shuttle drivers.
- Review the tour bus permit system to develop a process that requires a permit for all tour buses wishing to service the monument.
- To the extent practical, schedule work to avoid construction activity and construction-related delays during peak visitation.
- Limit construction-related traffic delays resulting from work at pull-offs, within parking lots, and along Muir Woods Road to a maximum of 15 minutes in each direction.
- Develop provisions for emergency vehicle access through construction zones.
- Prune low branches along trees lining the southbound side of Muir Woods Road south of the Conlon Lot to improve the sight distance for vehicles attempting to either make a left turn out of the parking lot driveway or make a left turn into the driveway from Muir Woods Road.
- Post signs on Muir Woods Road warning traffic of the pedestrian crossing at the Conlon Lot both before the intersection and at the intersection (following the latest standards published in the Manual on Uniform Traffic Control Devices).
- Design the proposed lift station and adjoining restrooms near the Nursery Lot to prevent any unpleasant odors from affecting visitors walking between the Nursey and Annex Lots.

### **Geology and Soils**

- Avoid or minimize disturbance to soils as much as possible.
- Evaluate existing topsoil for invasive, nonnative plant infestations.

- Remove topsoil heavily infested with invasive, nonnative plants. Salvage non-infested topsoil, store according to soil conservation guidelines, and replace once construction is complete.
- Implement erosion control measures that provide for soil stability and prevent movement of soils during rain events (i.e., silt fences and tarps).
- Aerate any ground surface temporarily disturbed during construction and replant with native vegetation to reduce compaction and prevent erosion.
- Use the stormwater pollution prevention plan and project specifications for dust control measures within construction areas, including active haul roads and staging areas, and engage a qualified stormwater practitioner to ensure compliance.

## Vegetation

- Develop a detailed revegetation and rehabilitation plan for enhancing areas disturbed by the project. The primary objective of the plan would be to reestablish a self-sustaining native plant community and ensure soil stability. Grade disturbed areas to natural contours; replace stockpiled topsoil; and mulch, replant, or reseed with native vegetation. Regularly monitor planted areas to determine whether remedial actions such as erosion control; invasive, nonnative plant species control; or replacement plantings are necessary.
- Avoid disturbance to particular species such as coast redwood (*Sequoia sempervirens*), California bottlebrush grass (*Elymus californicus*), leopard lily (*Lilium pardalinum*), and California buckeye (*Aesculus californica*) to the greatest extent possible.
- Prior to construction, survey for rare plants in areas where they may occur in vegetated construction zones. Conduct surveys for state (California Native Plant Society [CNPS]) and locally listed plants that may occur in the project area. If state or locally listed plants are found and cannot be avoided, transplant or collect and propagate seeds before revegetating disturbed areas. Monitor revegetated areas with rare plants for up to three years and take remedial actions to ensure that rare plants are reestablished.
- Prevent or minimize establishment and spread of nonnative vegetation, noxious weeds, and spread of diseases by
  - having all heavy equipment inspected by NPS biologists for proper level of cleanliness (invasive plant seed) upon entry at the work site
  - minimizing soil disturbance
  - pressure washing vehicles
  - covering haul vehicles
  - limiting vehicle and equipment parking in the project area
  - obtaining all fill, rock, or additional topsoil from the project area or obtaining weed-free material from approved sources outside the monument
- Minimize the spread of sudden oak death (*Phytophthora ramorum*) by selected removal of infected trees, stream baiting, conducting ground surveys, reducing the amount of standing water on high use trails, and advising visitors to remove mud from their boots before embarking on established trails.
- Monitor reclaimed areas annually after construction to determine if reclamation and revegetation efforts were successful.

## Water Resources and Hydrologic Processes

- Comply with and meet all relevant requirements under the Clean Water Act, including management of stormwater-related non-point source pollutants under the National Pollutant Discharge Elimination System.

- Implement best management practices for drainage and sediment control to prevent or reduce nonpoint source pollution and minimize soil loss and sedimentation in drainage areas. These practices may include, but are not limited to, silt fencing, filter fabric, temporary sediment ponds, check dams of pea gravel-filled burlap bags or other material, and/or immediate mulching of exposed areas to minimize sedimentation and turbidity impacts as a result of construction activities. Do not use plastic materials. Leave erosion control measures in place at the completion of construction to avoid adverse impacts on water resources, after which time NPS staff would be responsible for maintenance and removal.
- Use qualified NPS staff or certified wetland scientists to identify and clearly mark wetlands before construction work. Perform construction activities with caution to prevent damage caused by equipment, erosion, siltation, or pollutant discharges.

### Threatened and Endangered Species

- Prior to any construction-related activities, require a training session for all contractors, partners, and NPS staff participating in project-related activities in the project area. Have a qualified biologist conduct the training to familiarize personnel with sensitive resources in the project area. Provide personnel with a brief life-history and physical description of coho salmon, steelhead trout, northern spotted owl, marbled murrelet, California red-legged frog, and other sensitive wildlife in the area. Include staff resource contact information; identification of sensitive resources; the limits of the project area; general best management practices; and appropriate actions to take upon encountering special-status species or other wildlife in the training. Have all attendees sign an attendance sheet along with their printed name, company or agency, email address, and telephone number.
- Do not conduct construction activities at night or during dawn or dusk to minimize impacts on wildlife that are most active during these times, such as the northern spotted owl.
- Keep all waste and contaminants contained and remove them daily from the work site.
- Limit access and/or construction below the ordinary high water from June 15 to October 31 to minimize potential adverse effects on salmonid spawning and movement. The actual work window may be a subset of that time and would depend on the current water year, creek conditions, and timing of salmonid migrations.
- Implement measures to minimize potential adverse effects on northern spotted owls.
  - If construction commences between February 1 and July 31, conduct pre-construction surveys for northern spotted owls in suitable nesting habitat.
  - If northern spotted owl nests are detected during pre-construction surveys, conduct no work that raises noise levels above ambient background levels within 0.25-mile of an active nest.
  - From August 6 to September 30, limit construction activities that raise noise levels above ambient background levels to daytime hours beginning two hours after sunrise and ceasing two hours before sunset.
  - Within northern spotted owl habitat, avoid disturbance to native trees greater than 10 inches in diameter at breast height where feasible.
- Implement measures to minimize potential adverse effects on marbled murrelet:
  - If construction commences between March 15 and September 15, conduct one year of inland pre-construction surveys within 0.25 mile of potential marbled murrelet nesting habitat. Conduct surveys in accordance with *Methods for Surveying Marbled Murrelets in Forests: A Revised Protocol for Land Management and Research* (Evans Mack et al. 2003).
  - If marbled murrelet breeding activity or nests are detected during pre-construction surveys, conduct no work that raises noise levels above ambient background levels within 0.25 mile of an active nest.



- From August 6 to September 30, limit construction activities that raise noise levels above ambient background levels to daytime hours beginning two hours after sunrise and ceasing two hours before sunset.
- Implement measures to minimize potential adverse effects on California red-legged frogs:
  - Engage a qualified biologist to conduct a reconnaissance-level survey for California red-legged frogs within 48 hours prior to starting work in areas that provide potentially suitable habitat.
  - If California red-legged frogs are not found within the project area during the survey, proceed with work. If California red-legged frogs are observed, re-initiate consultation with the US Fish and Wildlife Service to determine appropriate avoidance and minimization measures. Report any sightings and/or injuries of California red-legged frogs to the US Fish and Wildlife Service within 24 hours.
  - Store pipes, conduits, and other materials that could provide shelter for California red-legged frogs above ground level to reduce the potential for animals to climb into the conduits and other materials.
- Have a qualified biologist conduct pre-construction surveys for dusky-footed woodrat (*Neotoma fuscipes*) prior to project-related activities. Avoid identified woodrat houses to the maximum extent practicable. If houses are unavoidable, contact the US Fish and Wildlife Service with proposed measures for review and approval prior to construction.

## Cultural Resources

- Identify and delineate archeological resources near the project area prior to project work. An archeologist who meets the Secretary of the Interior's professional qualification standards would monitor all new ground disturbance.
- Continue to coordinate with the California State Historic Preservation Office throughout the course of the project if unknown cultural resources are discovered as a result of the actions associated with the alternatives.
- In the event that human remains are discovered during construction activities, stop all work on the project and contact the monument's archeologist contacted immediately. As required by law, notify the coroner. Follow all provisions outlined in the Native American Graves Protection and Repatriation Act (1990).

## ALTERNATIVES CONSIDERED AND NOT CARRIED FORWARD

A number of alternatives were identified during internal and public scoping. During scoping, these options did not meet the purpose of, and need for, action; were not feasible; or had several disadvantages and were not carried forward for detailed analysis in this environmental assessment. They are described below.

### Expanded Annex Lot Only

This alternative would retain the existing footprint of the Entry Plaza and Main Lot and expand the Annex Lot by an additional acre to the southeast to contain parking for 182 privately owned vehicles. The expansion would address the proposed elimination of roadside parking within the monument and revegetate previously disturbed areas, such as the former Nursery Area. The alternative would include significant grading and fill. The National Park Service would remove large stands of coast live oak (*Quercus agrifolia*), Arroyo willow (*Salix lasiolepis*), and California buckeye to implement this alternative. Runoff into Redwood Creek would increase as a result of an additional acre of impervious surface in the Annex Lot. This alternative was considered and not carried forward

because it would have considerable adverse impacts on natural resources as a result of its large development footprint and proximity to critical habitat for coho salmon and steelhead trout.

### **Expanded Annex Lot and Nursery Parking**

Under this alternative, the Entry Plaza and Main Lot would be reconfigured to serve as a pedestrian space and drop-off location. The Annex Lot would be expanded by more than an acre to the southeast to contain parking for 107 privately owned vehicles and 18 buses, shuttles, and commercial use vehicles. Roadside parking would be eliminated within the monument entirely. A new lot, approximately 1 acre in size, would be developed in the former Nursery Area to contain parking for 70 privately owned vehicles, and driveway access would be added between the Annex Lot and Nursery Area. This alternative would locate all parking for visitors with disabilities in these lots instead of the Entry Plaza or the Main Lot, resulting in longer travel distances for these visitors. This alternative was considered and not carried forward because of its adverse impacts on large stands of coast live oak, Arroyo willow, and California buckeye. In addition, runoff into Redwood Creek would increase as a result of additional impervious surfaces.

### **Construct a Parking Lot on Panoramic Highway**

This alternative would develop a parking lot on Panoramic Highway. The proposed parking lot could be visually intrusive from the highway, resulting in viewshed impacts, and it would create the potential for adverse impacts from poor traffic circulation because additional traffic would need to access the busy intersection. Furthermore, large buses and shuttles in this area would pose a risk to pedestrians, cyclists, and other automobiles because the alternative would lack the appropriate design to accommodate vehicles of this size. Lastly, adverse effects would likely occur from the increased use of local trails, and further analysis of operations identified additional disadvantages. It was considered and not carried forward because public scoping indicated a lack of public support and the adverse impacts noted above.

### **All Visitors Arrive by Shuttle**

The National Park Service considered this alternative in the 2014 *Golden Gate National Recreation Area and Muir Woods National Monument Final General Management Plan / Environmental Impact Statement*. It was not carried forward because of its unsustainable cost, large displacement of visitors, and the inability of the National Park Service to maintain privately owned vehicle access while protecting monument resources.

### **Convert Muir Woods Road to One-Way Travel**

This alternative was considered and not carried forward because the National Park Service does not own the road. Furthermore, the alternative raised concerns regarding vehicular access for emergency vehicles, the public, and county. By creating only one-way access, public commenters noted that getting into and out of the valley could be difficult for a variety of users.

## **SUMMARY OF ENVIRONMENTAL CONSEQUENCES**

Table 2 provides a summary of environmental consequences for each resource area analyzed in “Chapter 4: Environmental Consequences.” Alternatives are determined to have beneficial or adverse impacts for each area of analysis.

**TABLE 2. SUMMARY OF ENVIRONMENTAL CONSEQUENCES**

Resource Area	Alternative 1: No-Action	Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	Alternative 3: Nursery Parking and Sustainable Access Improvements
<b>Visitor Experience and Safety</b>	The no-action alternative would maintain limited wayfinding and interpretive media. The restroom in the Entry Plaza would continue to be undersized and unable to meet current visitation levels. Safety issues would continue to exist between pedestrians and vehicles along Muir Woods Road and within parking lots. There would also be adverse impacts related to pedestrian and vehicle conflicts because of trails crossing parking lot driveways, vehicles approaching or exiting the Annex and Conlon Lots, and visitors crossing Muir Woods Road from the Conlon Lot. Shoulder parking would continue to impede emergency vehicle access to the monument.	Beneficial impacts would occur from improved wayfinding, additional interpretive media, and a relocated restroom in the Entry Plaza to accommodate visitation levels. A second restroom located near the former Nursery Area would also result in beneficial impacts. Adverse impacts would continue to occur from conflicts between pedestrians and vehicles along Muir Woods Road and within parking lots. While impacts would be beneficial from additional ABA-compliant parking spaces, minor, adverse impacts could occur from moving the ABA-compliant parking farther from the Entry Plaza. Short-term, adverse impacts from reduced parking availability, temporary trail and road closures, and noise from construction equipment would occur during the construction period.	Beneficial impacts would occur from improved wayfinding, additional interpretive media, and a relocated restroom in the Entry Plaza to accommodate visitation levels. A second restroom would be located near the former Nursery Area, also resulting in beneficial impacts. A new pedestrian woodland trail between the Nursery and Annex Lots would result in beneficial impacts by reducing conflicts between pedestrians and vehicles along Muir Woods Road. The removal of all shoulder parking would result in beneficial impacts on visitor safety from improved emergency access and provide a wide and clear right-of-way for navigation along Muir Woods Road. While impacts from additional ABA-compliant parking spaces and reduced vehicular congestion near those spaces would be beneficial, minor, adverse impacts could occur from moving the ABA-compliant parking farther from the Entry Plaza. There would be short-term, adverse impacts during the construction period from reduced parking availability, temporary trail and road closures, and noise from construction equipment.

TABLE 2. SUMMARY OF ENVIRONMENTAL CONSEQUENCES – CONTINUED

Resource Area	Alternative 1: No-Action	Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	Alternative 3: Nursery Parking and Sustainable Access Improvements
<b>Transportation</b>	Adverse impacts from roadside parking for 31 vehicles between the Conlon Lot and Muir Woods Road Bridge would continue. The existing parking lot configuration would be maintained, resulting in adverse impacts from congestion and queuing delays related to vehicles competing for available parking spaces and conflicts between buses and privately owned vehicles searching for or backing out of parking spaces. Trails crossing parking lot driveways and sight distance issues for vehicles approaching or exiting from the Conlon Lot would continue to create pedestrian and vehicle safety issues.	Alternative 2 would retain roadside parking for 30 vehicles south of Conlon Lot along Muir Woods Road; therefore, several adverse pedestrian and vehicle safety issues would continue to exist. The Dipsea Trail would be routed around the northwest perimeter of the Annex Lot, improving vehicle-pedestrian conflicts, and both modifications to the Annex Lot entrance and mitigation measures would improve vehicle safety. The four existing parking lots would be expanded or reconfigured, resulting in beneficial impacts. Parking spaces for privately owned vehicles would be removed from the Main Lot, reducing conflicts with buses, shuttles, and commercial use vehicles and improving overall shuttle/bus safety and circulation.	Alternative 3 would eliminate all shoulder parking along Muir Woods Road between Conlon Avenue and the Muir Woods Road Bridge and would include a Nursery Lot, eliminating adverse impacts from vehicles competing for roadside parking and improving pedestrian-vehicle safety. A new woodland trail would replace the existing Muir Woods Road pedestrian trail and travel along the perimeter of the parking lots, thus avoiding any trails crossing the driveways serving the parking lots and reducing vehicle/pedestrian conflicts. Similar to alternative 2, the Dipsea Trail would be routed around the northwest perimeter of the Annex Lot, improving vehicle-pedestrian conflicts, and both modifications to the Annex Lot entrance and mitigation measures would improve vehicle safety. The four existing parking lots would be reconfigured, resulting in beneficial impacts. Parking spaces for privately owned vehicles would be removed from the Main Lot, reducing conflicts with buses, shuttles, and commercial use vehicles and improving overall shuttle/bus safety and circulation. Impacts on transportation would be short term and adverse during construction of the lift station's power and force main lines under Muir Woods Road.

**TABLE 2. SUMMARY OF ENVIRONMENTAL CONSEQUENCES – CONTINUED**

Resource Area	Alternative 1: No-Action	Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	Alternative 3: Nursery Parking and Sustainable Access Improvements
<b>Geology and Soils</b>	Impacts on soils would be adverse from continued vehicular and pedestrian trampling, as well as surface runoff and sedimentation from existing damaged or undersized culverts. Indirect, adverse impacts on the health of vegetation from soil compaction would also continue.	Adverse impacts on soils would occur from removal, compaction, soil structure modification, and increased runoff on approximately 0.2 acre. Beneficial impacts from alternative 2 would include decreased turbidity and sedimentation in Redwood Creek, riparian rehabilitation in the Entry Plaza, and revegetation of the former Nursery Area.	Adverse impacts on soils would occur from removal, compaction, soil structure modification, and increased runoff on approximately 0.4 acre. Beneficial impacts from alternative 3 would include decreased turbidity and sedimentation in Redwood Creek, riparian rehabilitation in the Entry Plaza, and revegetation of the former roadside parking area.
<b>Vegetation</b>	Adverse impacts would continue from ongoing ground disturbance. Plant cover and biomass would remain low in a variety of areas because soil compaction could inhibit seed germination and restrict the root growth of plants. No adverse impacts on rare plants are anticipated because existing infrastructure does not currently affect these species.	Adverse impacts would occur from removing approximately 0.2 acre of vegetation from the Annex and Conlon Lots, the roadside parking area, and from the riparian area of Redwood Creek. Direct mortality of plants would also occur in the footprint of the new restrooms and infiltration trenches. Riparian rehabilitation in the Entry Plaza and revegetation of portions of the former Nursery Area would result in beneficial impacts. No impacts on rare plants are anticipated because they would be transplanted or propagated from seed prior to any construction activities.	Adverse impacts would occur from removing approximately 0.4 acre of vegetation in the former Nursery Area, Conlon Lot, and along the new pedestrian woodland trail; by pruning low-hanging branches along Muir Woods Road; and disturbing the riparian area of Redwood Creek. Direct mortality of plants would also occur in the footprint of the new lift station, restrooms, and infiltration trenches. Revegetation of the existing pedestrian trail along Muir Woods Road, riparian rehabilitation in the Entry Plaza, and revegetation of the former roadside parking area would result in long-term, beneficial impacts. No impacts on rare plants are anticipated because they would be transplanted or propagated prior to any construction activities.

TABLE 2. SUMMARY OF ENVIRONMENTAL CONSEQUENCES – CONTINUED

Resource Area	Alternative 1: No-Action	Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	Alternative 3: Nursery Parking and Sustainable Access Improvements
<b>Water Resources and Hydrologic Processes</b>	The no-action alternative would not upgrade stormwater management infrastructure, resulting in adverse impacts on water resources and hydrologic processes from continued erosion and runoff from parking lots, shoulder parking, instream disturbance, and erosion.	Expansion of the Annex and Conlon Lots, construction of the Dipsea Trail footbridge, and development of the new restrooms could temporarily result in erosion and sedimentation of surface waters. Two drainages in the Annex Lot would be temporarily and adversely affected during installation of two culverts and construction of stormwater management infrastructure. In the long term, beneficial impacts on water resources and hydrologic processes would occur from updating stormwater management infrastructure, revegetation and rehabilitation of disturbed areas, and removal of potential flood hazards.	Expansion of the Conlon Lot; construction of the Nursery Lot, new lift station, new woodland pedestrian trail, and the Dipsea Trail footbridge; and development of new restrooms could temporarily result in erosion and sedimentation of surface waters. One drainage in the former Nursery Area would be temporarily and adversely affected during installation of a culvert and construction of stormwater management infrastructure. In the long term, beneficial impacts on water resources and hydrologic processes would occur from updating stormwater management infrastructure, revegetation and rehabilitation of disturbed areas, and removal of ground disturbance and potential flood hazards.
<b>Threatened and Endangered Species</b>	The no-action alternative would not upgrade stormwater management infrastructure, resulting in continued impacts on coho salmon and steelhead trout habitat in Redwood Creek, commensurate with water quality impacts from erosion and runoff. In addition, the no-action alternative would not construct a Dipsea Trail footbridge over Redwood Creek, resulting in continued habitat disturbances if visitors walk through the creek bed rather than crossing the wooden plank.	Potential temporary impacts on coho salmon and steelhead trout habitat in Redwood Creek would occur as a result of erosion and sedimentation, followed by long-term, beneficial impacts. Parking lot expansion would result in loss of northern spotted owl foraging habitat. However, rehabilitating and revegetating the erosion hazard area of the Entry Plaza would increase habitat for the northern spotted owl, resulting in beneficial impacts. Impacts on the marbled murrelet and California red-legged frog are not anticipated because these species are not known to occur within the project area. Overall, alternative 2 may affect but is not likely to adversely affect threatened and endangered species.	Potential temporary impacts on coho salmon and steelhead trout habitat in Redwood Creek could occur during construction activities as a result of erosion and sedimentation. These would be followed by long-term, beneficial impacts. Expansion of the Conlon Lot would result in loss of northern spotted owl foraging habitat. However, rehabilitating and revegetating the erosion hazard area of the Entry Plaza would increase habitat for the northern spotted owl, resulting in beneficial impacts. Impacts on the marbled murrelet and California red-legged frog are not anticipated because these species are not known to occur within the project area. Overall, alternative 3 may affect but is not likely to adversely affect threatened and endangered species.



**TABLE 2. SUMMARY OF ENVIRONMENTAL CONSEQUENCES – CONTINUED**

Resource Area	Alternative 1: No-Action	Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements	Alternative 3: Nursery Parking and Sustainable Access Improvements
<b>Cultural Resources</b>	The no-action alternative would not disturb existing cultural resources.	Alternative 2 would not disturb archeological sites. The proposed new bridge and trail reroute would not adversely affect the Dipsea Trail. Archeologically sensitive areas in the former Nursery Area and the Conlon Lot could be disturbed during demolition of the structures in the former Nursery Area and enlarging the Conlon Lot. However, impacts would be avoided through proper mitigation measures.	Alternative 3 would not disturb archeological sites. The Dipsea Trail would not be adversely affected by the proposed new bridge and trail reroute. Archeologically sensitive areas in the Nursery and Conlon Lots could be disturbed, but impacts could be avoided through proper mitigation measures. Removing the existing Muir Woods Road pedestrian trail and replacing it with a new woodland pedestrian trail would have a beneficial impact on the monument, provided that the eastern end of the trail avoids sensitive areas and archeological monitoring occurs during construction.

This page intentionally left blank.

## CHAPTER 3: AFFECTED ENVIRONMENT

### INTRODUCTION

This chapter presents information about the existing environment at the monument to understand the potential impacts from the alternatives. Issues and impact topics discussed in this chapter include visitor experience and safety, transportation, geology and soils, vegetation, water resources and hydrologic processes, threatened and endangered species, cultural resources, and climate change (where applicable within the impact topics).

### VISITOR EXPERIENCE AND SAFETY

Visitor experience and visitor safety conditions at the monument play a key role in the purpose of, and need for, action, and are affected by visitation levels and arrival rates that exceed the monument's user capacity.

#### Visitor Experience

Within the project area, several overlapping components contribute to the visitor experience at the monument, including user capacity; the arrival, entry, and departure experience; the ability to navigate within the monument; the availability of amenities; the accessibility of parking; and the availability of interpretive and educational opportunities.

**User Capacity.** The National Park Service defines user capacity as the types and levels of visitor and other public use that can be accommodated, while sustaining the desired resource conditions, social conditions, and visitor experiences that complement the purpose of the NPS unit (NPS 2009). This definition acknowledges that desired conditions and visitor experiences are often related to a variety of factors, not merely to the number of people. User capacity considers how people get to a park unit, what they do while there, where they do it, how long they stay, and what impact their activities has on resources and the experience of other visitors (NPS 2015b).

Managing visitation to levels that meet user capacity rates described in the *Record of Decision* for the *Golden Gate National Recreation Area and Muir Woods National Monument Final General Management Plan / Environmental Impact Statement* is among the key goals of the monument (NPS 2015e). As a step toward meeting this goal, the monument completed the 2015 *Muir Woods National Monument Reservation System Environmental Assessment* and *Finding of No Significant Impact* for a reservation system to help address exceedances of user capacity at the monument (NPS 2015b, d). The reservation system is expected to be fully operational by January 2018. Both of these documents provide definitions and detail for identifying desired conditions, indicators, and standards that fulfill statutory requirements; align with the monument's purpose and significance; and allow present and future opportunities for public enjoyment of the monument.

**Arrival, Entry, and Departure Experience.** Visitors arrive at the monument in privately owned vehicles, shuttle buses, tour buses, bicycles, and on foot, but the majority arrive in privately owned vehicles. During peak visitation, existing parking lots fill to maximum capacity and visitors find informal parking areas, such as along the roadside. Traffic congestion during this time increases substantially as drivers circle around parking lots looking for a parking space and drop passengers off in the Main Lot before continuing to search for parking. Parking areas are spread over approximately a half mile between the visitor center and Muir Woods Road Bridge. Visitors parking informally along Muir Woods Road may have to walk more than a mile to the monument entrance,

sharing the road with vehicular traffic. This experience can create feelings of stress and anxiety as part of the visitors' arrival and departure experience (NPS 2012b).

The entry experience encompasses the visitors' activities from the time they arrive via their transportation mode until they pass through the admission gate at the Entry Plaza. During this time, visitors prepare themselves for their upcoming experience. Activities in this area include using the restroom, resting, sightseeing, viewing interpretive media, decompressing after a long trip, planning their itinerary within the monument, visiting the visitor center and bookstore, and paying the entrance fee before experiencing the forest. The Entry Plaza was previously a parking lot that was modified to provisionally meet the needs of visitors. This area can, however, become very crowded with visitors who have been dropped off and are waiting for their driver to park and rejoin their party, arrival surges from tour and shuttle buses, and occasional backups at the ticket booth (NPS 2012b). Furthermore, noise associated with a lack of separation from the tour and shuttle bus drop-off area and the presence of a restroom in the Entry Plaza disrupts the natural soundscape along Redwood Creek (NPS 2012c).

**Wayfinding Opportunities.** Multiple trails are located within the project area that provide access to the Entry Plaza and the monument. The Redwood Creek Trail, Dipsea Trail, and Deer Park Fire Road all provide pedestrian access from shoulder parking along Muir Woods Road into the monument. Redwood Creek Trail also extends between the Main Lot and the Annex Lot. Nearby public lands, including Mount Tamalpais State Park, provide trail access directly into the monument. However, because few visitors are aware of these alternate and historical access opportunities and because wayfinding signage is currently inadequate, most visitors walk directly through parking lots or along the side of Muir Woods Road before arriving at the Entry Plaza (NPS 2012c, 2014a). Dipsea Trail, which traverses the project area, drops steeply down a stairway to Muir Woods Road across from the Annex Lot. Trail users must cross Muir Woods Road and the Annex Lot to continue along the trail to cross the wooden plank at Redwood Creek, which is often removed in the winter and spring because it washes away during high flows. For more details on the trails within the project area, see the "Pedestrians" subsection under "Transportation."

**Visitor Amenities.** One restroom, built in the 1960s, is located along Redwood Creek between the Entry Plaza and the Main Lot. This facility is in moderate condition and is located in the erosion hazard area of the monument. The restroom is undersized and does not accommodate current levels of visitation. Visitors arriving at the monument and parking in overflow parking may need to walk more than a mile to reach the restroom and have been found relieving themselves in inappropriate areas (NPS, Aviles, pers. comm. 2016b). The location of the restroom building also conflicts with interpretive objectives for Redwood Creek because this location offers a good opportunity to view the stream channel and surrounding riparian forest (NPS 2012c).

**Visitor Accessibility Parking for Architectural Barrier Act Standards.** The existing vehicle drop-off and pick-up zone near the monument entrance serves visitors with disabilities. Nine ABA-compliant parking spaces are available in the Entry Plaza, exceeding accessibility standards required under the Architectural Barriers Act of 1968 by three spaces (DoD et al. 2015). The ABA-compliant parking spaces currently bring visitors in close contact with administrative vehicles accessing operational areas in the Entry Plaza.

**Interpretive and Educational Opportunities.** Visitors can experience the interpretive and educational opportunities available at the monument in various ways, including viewing brochures and exhibits available at the visitor center; taking self-guided walks; and attending talks, tours, and programs led by monument staff or in collaboration with local organizations.

While some interpretive opportunities are available in the project area, such as at the Dipsea Trailhead near the Annex Lot, existing interpretive media do not prepare visitors for their experience at the monument or mitigate the tendency for visitors to rush directly to the admission gate at the Entry Plaza (NPS 2012b). As a result, the Entry Plaza is less a part of the visitor experience.

## **Visitor Safety**

Muir Woods Road is narrow, winding, and steep in areas. Large vehicles do not always stay in their lanes around curves, presenting danger to oncoming traffic, including other vehicles and bicyclists. Additionally, shoulder parking results in potential safety issues for pedestrians crossing the road to access the monument entrance (NPS 2014b).

When formal parking lots are full, visitors typically park in areas along Muir Woods Road, causing road congestion and potentially unsafe conditions for drivers, bicyclists, and pedestrians, as discussed below. A memorandum of understanding between the National Park Service and Marin County recognizes a desire to cooperatively implement a parking reservation, public transit, and enforcement system to substantially improve these conditions. A primary goal expressed in the memorandum of understanding is to improve traffic and pedestrian safety issues that arise from parking along Muir Woods Road (NPS 2015d).

Within the project area, several areas contribute to visitor safety concerns, including potential conflicts between pedestrians and vehicles, potential conflicts between vehicles and bicycles, potential conflicts between vehicles, and accessibility for emergency vehicles.

**Conflicts between Pedestrians and Vehicles.** In areas of high pedestrian and vehicle congestion, the potential for pedestrian-vehicle conflict can arise as pedestrians and vehicles attempt to navigate roadways and busy parking areas and as privately owned vehicles, tour buses, and shuttle buses drop off passengers in areas with high pedestrian traffic. Conflicts may occur in parking areas, in passenger drop-off areas, and along Muir Woods Road. Specific areas of potential conflict occur where (1) pedestrians traveling along the Dipsea Trail must cross Muir Woods Road to continue on the trail; (2) pedestrians must cross the vehicle entry/exit point at the Annex Lot along Muir Woods Road; and (3) pedestrians crossing from the Conlon Lot to the trail destined for the Entry Plaza must cross Muir Woods Road along a curve and under tree canopy, a location in which approaching vehicles have limited visibility. Visitors also walk along Muir Woods Road, creating increased potential for pedestrian and vehicle conflicts as privately owned vehicles pull in and out of roadside shoulders and make U-turns.

**Conflicts between Bicyclists and Vehicles.** Although the volume of bicyclists is lower than pedestrians and vehicles, visitors cycling to the monument share the road lanes on Muir Woods Road with vehicular traffic and must contend with crowded traffic conditions on busy days (NPS 2012b). Conflicts arise between bicyclists and vehicles along the narrow and winding roads, particularly between coach buses and bicyclists. Conflicts also arise when vehicles park along the shoulder of Muir Woods Road because drivers may not be accustomed to looking for cyclists as they pull into or out of parking spaces. Additionally, passengers in vehicles parking along the shoulder of Muir Woods Road may not look for bicyclists before opening the vehicle door.

**Conflicts between Vehicles.** In areas of high congestion where drivers navigate busy parking lots and narrow roadways, the potential for conflict between vehicles increases. Privately owned vehicles and tour and shuttle buses dropping off passengers occur in the same area within the Main Lot, creating the potential for vehicle conflicts. Use of shoulder parking increases the potential for conflicts between multiple privately owned vehicles as drivers attempt to navigate the area in search of available parking, turn their vehicles in the middle of the road into oncoming traffic, park in informal spaces, and back up into oncoming traffic from roadside spaces.

**Emergency Access and Circulation.** Muir Woods Road is narrow, particularly during peak visitation when visitors park along roadway shoulders and the road is crowded with pedestrians making their way to and from the Entry Plaza. Congestion at the Entry Plaza associated with privately owned vehicles and buses dropping off and picking up passengers results in limited space to maneuver. These factors result in a highly restricted traffic circulation that limits the ability of emergency vehicles to quickly access the area.

## TRANSPORTATION

Muir Woods Road provides the primary access to the monument. The road is between 24 and 30 feet wide and has a striped centerline to indicate no passing is allowed. The posted speed limit has a county-designated speed varying between 25 and 35 miles per hour (25 miles per hour within the entire monument area). The National Park Service works cooperatively with the County Sheriff and California Department of Parks and Recreation with enforcement on Muir Woods Road. Marin County owns and maintains the roadway (NPS 2012d).

Travel modes evaluated include pedestrian, bicycle, transit, and privately owned vehicle. Existing parking areas were also evaluated for visitor access to the monument. Pedestrians can access the monument via trails outside the monument's boundaries. However, bicycles, transit, and privately owned vehicles provide the majority of transportation into and out of the monument.

## Parking

Parking is provided in four off-street lots and informally permitted along Muir Woods Road. The off-street lots are the Entry Plaza (with 9 spaces for visitors with disabilities and 2 spaces for privately owned vehicles), the Main Lot (43 spaces), the Annex Lot (114 spaces), and the Conlon Lot (49 spaces). Shoulder parking is allowed along the westbound side of Muir Woods Road beginning east of the Conlon Lot. Up to 31 shoulder parking spaces exist between the Conlon Lot and Muir Woods Road Bridge. On the Mount Tamalpais State Park side of Redwood Creek, informal shoulder parking occurs on both sides of Muir Woods Road. However, the implementation of the reservation system will phase out shoulder parking on Muir Woods Road south of the bridge.

Figure 7 shows the existing shoulder parking near the Conlon Lot along Muir Woods Road. Table 3 contains the existing parking areas and space counts within the monument boundaries.



SOURCE: NPS 2011b

**FIGURE 7. SHOULDER PARKING NEAR CONLON LOT**

**TABLE 3. PARKING WITHIN MONUMENT BOUNDARIES**

<b>Lot Name</b>	<b>ABA-Compliant Parking</b>	<b>Privately Owned Vehicles</b>	<b>Total (Privately Owned Vehicles)</b>	<b>Transit (Buses and Shuttles)</b>	<b>Total (All Vehicles)</b>
Entry Plaza	9	2	11	0	11
Main Lot	0	27	27	16	43
Annex Lot	0	114	114	0	114
Conlon Lot	0	49	49	0	49
Roadside Parking	0	31	31	0	31
Total	9	223	232	16	248

## Pedestrians

A network of walking trails connects the on- and off-street parking areas to the monument's entrance. Beginning from the monument's entrance and heading east, Redwood Creek Trail runs along the creek side of the Entry Plaza and Main Lot. The trail splits along the eastern side of the Main Lot with the southern leg connecting to the southwestern corner of the Annex Lot. The northern leg follows Muir Woods Road, crosses both driveways serving the Annex Lot, and continues along Muir Woods Road until the far side of Redwood Creek, where the trail merges with



the roadway on its way to Muir Beach. The pedestrian network varies in width but maintains an approximate width of 5 feet. Between the Muir Woods Road Bridge and monument entrance, the trail maintains its own right-of-way and has a wooden fence that separates it from Muir Woods Road. Tree stumps, utility poles, and No Parking signs also are situated on the trail, sometimes creating small areas with narrow widths.

Visitors parking in the Conlon Lot must cross Muir Woods Road to access the main pedestrian trail to the monument entrance. Drivers have a limited sight distance to see pedestrians crossing at the Conlon Lot when driving westbound from the Muir Woods Road Bridge toward the Conlon Lot. This issue is also discussed in the “Privately Owned Vehicles” subsection below.

## **Bicycles**

Although bicycle use is permitted on Muir Woods Road and the Panoramic Highway to access the monument, it is not allowed within the monument (NPS 2016c). Bicycle racks are located near the monument entrance approximately 80 feet west of the ABA-compliant parking in the Entry Plaza (NPS n.d.). Bicyclists can create congestion on the roadways because of their lower speed and bicycle-vehicle conflicts on the narrow travel ways and winding roadways that connect the monument to the rest of Marin County (NPS 2012b).

## **Privately Owned Vehicles**

Visitors arriving in privately owned vehicles access the monument by driving on Muir Woods Road either from Panoramic Highway or Highway 1 from Muir Beach. Based on the estimated number of vehicles per hour during peak visitation (i.e., Saturday in July at 11:00 a.m.), potentially more than 200 vehicles per hour access the monument (NPS, Brown, pers. comm. 2016d). Parking demand regularly exceeds supply because only 232 privately owned vehicle spaces are available between the Muir Woods Road Bridge and the monument entrance, resulting in congestion (NPS 2015b).

Drivers seeking parking can cause unsafe conditions for vehicles and pedestrians walking from their vehicles to the monument entrance and for vehicle queuing. Visitors who park along the roadway and walk in active travel lanes along Muir Woods Road or across parking lots with a continuous flow of vehicles can cause pedestrian-vehicle conflicts. Driver frustration can also be an issue as drivers attempt to find a place to park after committing to drive to the monument (NPS 2015b).

The driveway serving the Conlon Lot exits onto Muir Woods Road in the middle of a roadway curve. According to the sight distance tables provided in the American Association of State Highway and Transportation Officials (AASHTO) 2011 *Policy on Geometric Design of Highways and Streets*, a minimum of 280 feet of unobstructed view is required for a left turn from a STOP sign onto a road with a speed limit of 25 miles per hour; the value for a right turn is 240 feet (AASHTO 2011). Because the road is located in a heavily forested area with trees lining the roadway, a driver can only see vehicles approaching up to an estimated maximum of 100 feet to the left and approximately 300 feet to the right. Based on the AASHTO values, the sight distance for a left turn is approximately 200 feet less than what needs to be provided for a safe sight distance. A similar problem exists for vehicles driving southbound away from the Main Lot on Muir Woods Road and attempting to make a left into the Conlon Lot. According to the American Association of State Highway and Transportation Officials, 290 feet of sight distance is required; however, only 100 feet are available, resulting in an unsafe sight distance for vehicles attempting to enter by making a left turn (AASHTO 2011).

## **Public Transportation**

Access to the monument is available through a seasonal 37-seat shuttle bus operated between two park and ride facilities in Sausalito, California, between April and October. The Route 66 shuttle from the Pohono Street Park & Ride offers weekend and holiday service at 10-minute headways from Memorial Day to Labor Day, and 20-minute headways in April, May, September, and October. The Route 66F shuttle from the Sausalito Ferry offers daily 30-minute headways from Memorial Day to Labor Day. The same route offers weekend 1-hour headways in April, May, September, and October. The roundtrip cost is \$5.00 for either shuttle and is collected at the monument entrance, where riders obtain a receipt to present to the bus driver to board for the return trip from the monument (Marin Transit 2016).

In 2015, the shuttle carried more than 110,700 passengers; 25% of this total volume occurred in July and 44.5% occurred in July and August. Because of limited seating capacity, uneven passenger arrivals, and the requirement barring standees because of the winding travel route, some individuals are not able to board the first available bus. These people are called pass-ups. About 25% of pass-ups had to wait more than 30 minutes before boarding the shuttle (Marin Transit 2015).

Private tour operators provide bus service to the monument in both large 35-passenger buses and smaller vans and town cars. These services operate from San Francisco or Sausalito to the monument and vie for the 16 designated parking spaces located in the Main Lot. The vans and buses use Panoramic Highway to access Muir Woods via upper Muir Woods Road and exit via lower Muir Woods Road. The Main Lot can accommodate up to 35-foot tour buses. Although not permitted to enter the monument, 40-foot to 45-foot buses sometimes arrive and require extra help by parking ambassadors to guide them through the lot. In addition to the oversized buses, the small vans and town cars take up valuable spaces, requiring the 35-foot buses to park farther away from the monument entrance (NPS 2012d).

The monument requires private tour companies to purchase an annual permit, better known as a Commercial Use Authorization (CUA), to access Muir Woods more than one time per month. The companies that have the CUA permits are not allowed to have more than two commercial carriers at Muir Woods at any one time (NPS 2016c, e). The Main Lot has also recently been reconfigured to maximize space with areas identified for both larger and smaller vehicles and reserved lanes for shuttles. As of 2012, more than 50 companies had purchased CUA permits (NPS 2012d).

## **GEOLOGY AND SOILS**

Past road construction and other developments have disturbed soils within the monument and led to a decrease in soil stability and an increase in erosion. In recent years, some effort has been made to restore soil to naturally occurring conditions through removal of paved trails in favor of raised boardwalks, especially in the monument beyond the entry arch. Some areas of the monument have been fenced to protect soil from compaction caused by foot traffic. However, many areas of the monument are still subject to erosion processes because a few trails are paved. Surface disturbances, such as cuts for trails and roads, vegetation clearing, and alteration of surface water drainages, can trigger or lead to slope failures (NPS 2014a). A natural resources assessment completed in 2011 ranked the soil conditions at the monument as fair because of historical logging, grazing, farming, residential development, and compaction from pedestrians (NPCA 2011).

The project area comprises the Centissima-Barnabe complex, Blucher-Cole complex, Dipsea-Barnabe very gravelly loams, and Bonnydoon gravelly loam (figure 8). Within the project area, the Centissima-Barnabe complex covers the northern portion, and the Blucher-Cole complex covers

most of the southern portion. Dipsea-Barnabe very gravelly loams cover a little more than 2 acres at the southern portion of the project area, while Bonnydoon gravelly loam covers approximately a sixth of an acre (USDA, NRCS 2016). K values, which describe the soil susceptibility to erosion and the rate of runoff, have been identified for each soil type. Soils with a low K value are susceptible to easy detachment but have a low runoff rate. Soils with a moderate K value are moderately susceptible to detachment and have a moderate runoff rate. Soils with a high K value are the most erodible and have a high rate of runoff.

The Centissima-Barnabe complex is primarily derived from weathered soft sandstone and shale, and the unit is described as poorly suited for recreational development. This unit has a low to moderate K value and a moderate susceptibility to runoff and erosion. Vegetated cover on this unit can help to prevent erosion, and plant cover can be maintained by limiting traffic over the area (USDA, SCS 1985). The Centissima-Barnabe complex is the most commonly encountered soil type within the monument and supports all of the slope redwood stands (McBride and Jacobs 1978).

The Blucher-Cole complex is formed in alluvium from various kinds of rocks. Because of the slow permeability of this soil type and the risk of flooding, this complex is poorly suited for recreational development. The unit has a moderate to high K value, a moderately high susceptibility to erosion, and a high rate of runoff. Erosion on this unit can be controlled by maintaining adequate plant cover (USDA, SCS 1985). Proper drainage measures are required to make it suitable for road development, and septic tank absorption fields do not function properly during rainy periods. The largest redwood and hardwood trees within the monument occur on this soil type (McBride and Jacobs 1978).

The Dipsea-Barnabe soil type is derived from sandstone and shale, and the unit is poorly suited for recreational development because it is found on steep slopes. This unit has a coarse texture with a low K value and a high susceptibility to erosion and a low rate of runoff. Proper drainage systems and waste material placement can help prevent and control erosion. Native vegetation on this soil type consists of mixed hardwoods and conifers (USDA, SCS 1985).

The Bonnydoon soil type is derived from fractured sandstone and is found on uplands. The unit has a high K value because runoff is very rapid, and the hazard of erosion is very high. Because of the steepness of slope, the soil type is poorly suited for recreational or site development. Intensive runoff control measures are required. Native vegetation on this soil type consists mainly of grasses and forbs (USDA, SCS 1985).

As climate change impacts become more apparent, soil conditions will likely change over time. Higher intensity and more frequent rainfall may lead to more erosion in susceptible soils and an increase in runoff when soils reach saturation levels. With rainfall amounts increasing, erosion and runoff levels may increase at a greater rate—on the order of a 1.7 ratio (Nearing et al. 2004).

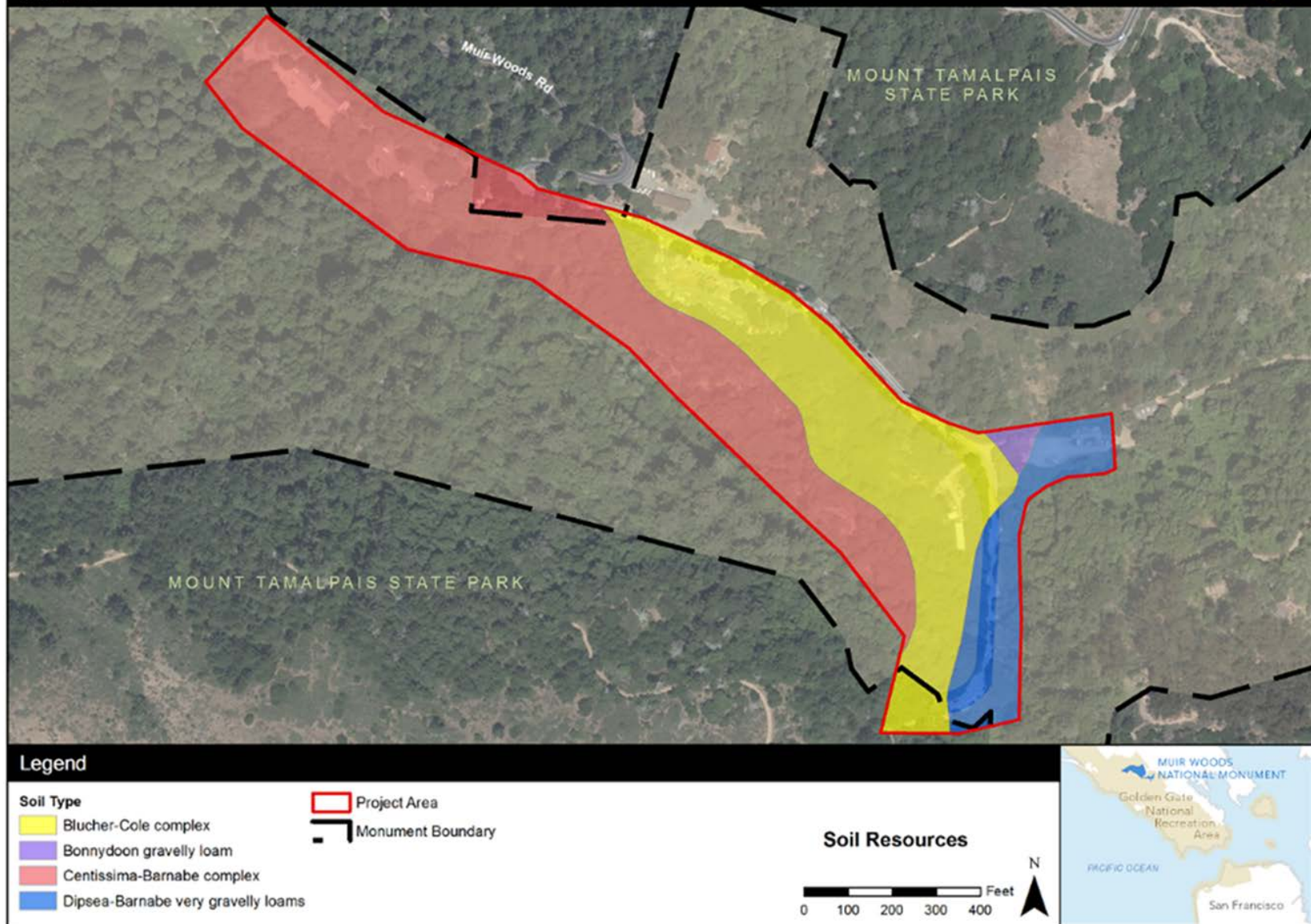


FIGURE 8: SOIL TYPES IN THE PROJECT AREA

## VEGETATION

The project area is outside the redwood forest and comprises 47 distinct stands of vegetation. Based on the Holland and Keil classification scheme, 17 different types of vegetation were classified (figure 9). Red alder (*Alnus rubra*) and bay laurel-swordfern (*Umbellularia californica*; *Polystichum munitum*) had the highest coverage, while California buckeye had the least (NPS 2013a).

“NPSpecies,” a National Park Service database, has 318 vascular plant species documented—13 of which are under review to confirm their presence—within the monument. Approximately 27 other species are probably present but have not been verified, and 17 species are unconfirmed. Of the 318 species, 44 are listed as historical, meaning they were previously present but are believed to be extirpated, and 74 vascular plants present at the monument are nonnative (NPS 2016f). A survey of vegetation within the project area found 180 species; 97 were native plants and 83 were nonnative. Of the 180 species, 43 had no prior record of occurring at the monument (NPS 2013a).

Few native plant species of concern are found within the monument. The Oakland star tulip, or mariposa lily (*Calochortus umbellatus*), is described in the fire management plan as a CNPS-listed species, which has been found “in the vicinity of Muir Woods” in grasslands (NPS 2005). Nine different vegetation alliances were listed as having either a global or state conservation ranking of 3, making them sensitive to disturbance (NPS 2013a). However, only two rare plant species were found in the project area: California bottlebrush grass and leopard lily.

California bottlebrush grass has a CNPS ranking of 4.3 for being uncommon in California, although it is not threatened or endangered. The only active management for rare plant species in the monument has been some fencing along the valley floor to protect California bottlebrush grass, which appears to have been effective (NPCA 2009). Leopard lily has no federal, state, or CNPS listing, but the species is of local concern to the monument’s natural resource management staff because they believe it was once more widespread within the monument (NPS 2013a). California buckeye is also of particular importance to the monument. Though the species is not listed as threatened or endangered by the state or federal government, buckeye-dominated vegetation is rare in California. Furthermore, buckeye-dominated woodlands are especially uncommon in coastal regions and likely have the most unique associated taxa of any buckeye stands found elsewhere (NPS, Steers, pers. comm. 2013b).

Other native vegetation types—coastal scrub/chaparral and grassland—have been highly altered because of a combination of fire suppression; land use practices; and invasive, nonnative species (NPS 2005, 2011c). Coastal scrub/chaparral occurs at upper elevations and seems to be invading grasslands as a result of fire suppression (NPS 2005). Coniferous forests are invading the lower elevations of the scrublands. Within the Redwood Creek Watershed, nonnative, Mediterranean annual grasses dominate most native grasslands that occupy ridgetops and slopes (NPS 2011c).



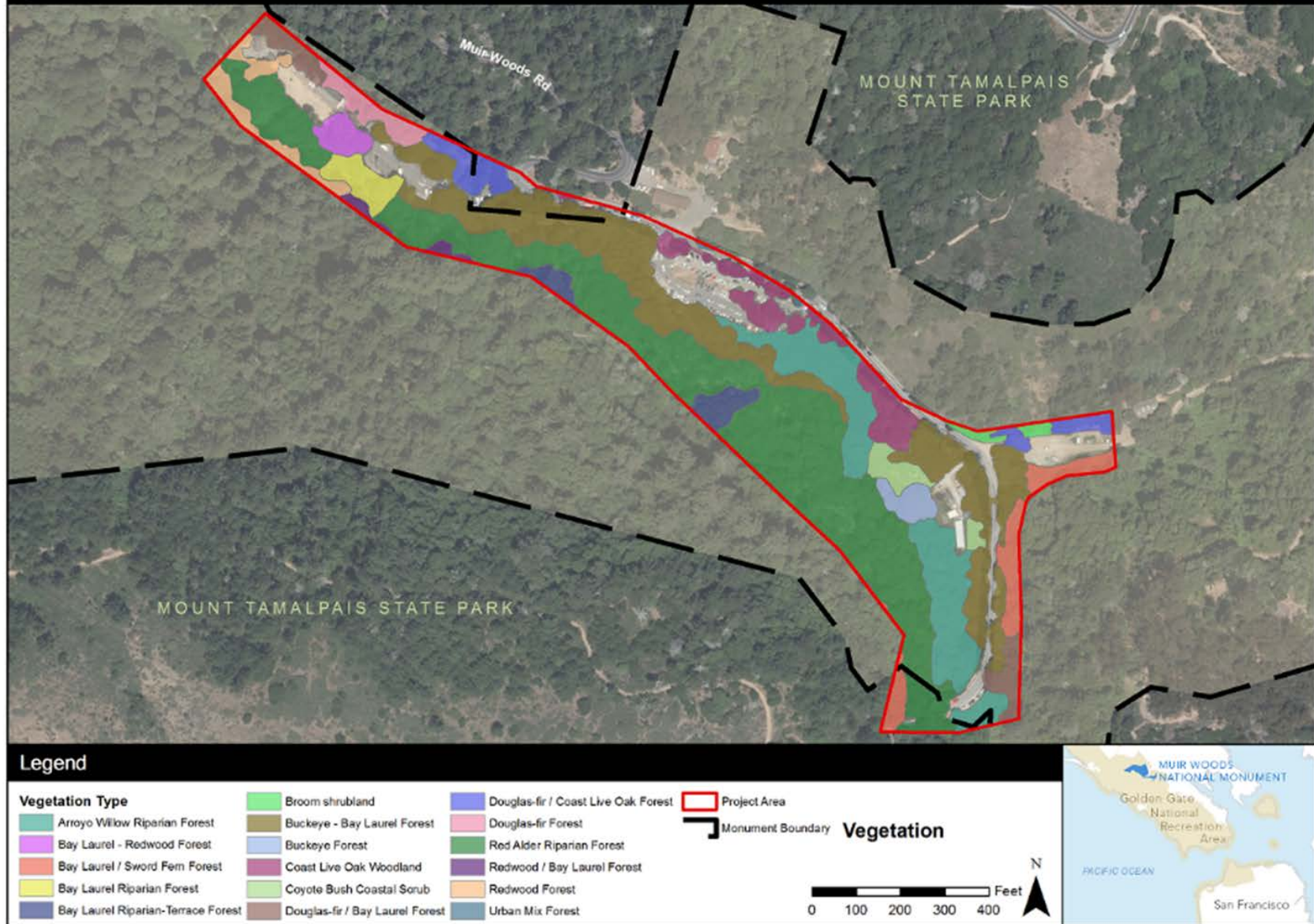


FIGURE 9: VEGETATION TYPES IN THE PROJECT AREA

Invasive, nonnative plants are a considerable problem within all other vegetation types. Isolated patches of nonnative aquatic plants appear to be limited in extent. Today, three main nonnative species of concern occur at the monument: the forget-me-not (*Myosotis sylvatica*; *Myosotis latifolia*), panic veldtgrass (*Ehrharta erecta*), and traveler's joy (*Clematis vitalba*). Originally introduced to improve the aesthetics of the forest, forget-me-nots quickly spread throughout the monument. Fortunately, the monument has kept this species under control along the canyon floor, although the ability to eliminate it from steep, inaccessible slopes is a staff concern. Along Redwood Creek, removal of this species led to an increase in native plant cover. Control methods for panic veldtgrass and traveler's joy are still being developed and tested. Outside the riparian forests, monument staff has worked to eliminate other invasive species, including cape ivy (*Delairea odorata*), brooms (*Genista monspessulana*; *Cytisus scoparius*; *Spartium junceum*), acacia (*Acacia melanoxylon*; *Acacia decurrens*), and other species (NPCA 2009).

Sudden oak death, a nonnative plant disease caused by the microscopic pathogen *Phytophthora ramorum*, is present at the monument, and efforts have been made to reduce its spread by selectively removing infected trees, stream baiting, conducting ground surveys, reducing the amount of standing water on high use trails, and advising visitors to remove mud from their boots before embarking on established trails.

The monument includes the most intact old-growth coast redwood forest in the Bay Area. It is estimated that nearly 2 million acres of forest similar to those at the monument once covered a narrow strip along the coasts of California and Oregon. Today, 97% of this forest area has been displaced or degraded, and most coast redwoods now grow in protected second- and third-growth forests or managed timber plantations. At the monument, the redwood forest “extends along the canyon floor north beyond the monument, across most of the northeastern-facing canyon wall up to the Dipsea Trail, and along portions of the lower southwest-facing wall and adjoining side canyons extending to Canopy View Trail. In these areas, the redwoods thrive in a cool microclimate with loamy soils and ample moisture from fog, rain, and groundwater” (NPCA 2009).

Although this forest is largely isolated within the larger landscape because of natural conditions (i.e., physiography and the restricted environmental requirements of redwoods), the tracts of forest within the monument have a history of protection that preserved many of the structural and functional ecological features. However, small areas within the monument's redwood forest show evidence of logging in the late 19th century (McBride and Jacobs 1978). Though recreation and tourism (e.g., trampling, campfires, and collecting plants) and park management (e.g., stream alteration and removal of woody debris) have historically degraded vegetation, some areas have been able to recover within a period of years or decades. Studies have shown that areas formerly devoid of vegetation along Redwood Creek have recovered to the point that it is not possible to discern restoration plantings from natural riparian vegetation (NPS 2014a). NPS staff and other resource protection organizations monitor the health of the redwood forest on a regular basis and have determined the health of the forest to be good. Public ownership of surrounding lands helps maintain certain ecosystem functions within the monument's redwood forests (NPS 2014a).

The effects of climate change on the monument's vegetation are potentially threatening. Fog plays a large role in the coast redwood and Douglas-fir ecosystem. Fog frequency has decreased by 33%—or three fewer hours of fog each day—along California's coast since the early 20th century (NPCA 2011). Precipitation and storm intensity could likely increase in the Bay Area, which would likely increase erosion and floods (NPS 2014a). Because of the coast redwood trees' resistance to adverse effects from flooding, this could help coast redwood seedlings establish, though other species could be negatively affected (NPCA 2011).



## **WATER RESOURCES AND HYDROLOGIC PROCESSES**

### **Groundwater**

In general, groundwater resources are important to recharge surface waters and wetlands, support wildlife habitat, and provide municipal and agricultural water. Marin County is underlain by impermeable Franciscan bedrock, resulting in a perched water table. No wells operate in the monument; however, springs upstream of the monument supply water for Marin Municipal Water District (NPS 2014a). The incision of Redwood Creek and its tributaries has likely resulted in lowered base groundwater levels and less groundwater storage potential (Anderson et al. 2015).

### **Surface Water**

The primary water resource in the monument is Redwood Creek (figure 10), a perennial stream that flows from its headwaters on Mount Tamalpais through the monument and to the Pacific Ocean (NPS 2014a). Several intermittent or ephemeral tributaries discharge into Redwood Creek from the northeast or east in the boundaries of the project area, including Camino del Canyon and Conlon Creek (Coopridier 2004; Ryan 2016). Redwood Creek and its tributaries flow down steep slopes and through canyons upstream of the monument. As Redwood Creek enters the monument, it is characterized by a slope of less than 2% and a gravel and cobble bed (NPS 2011c, 2014a).

Conlon Creek flows parallel to and along the east side of Muir Woods Road; however, historically, it flowed in a more southwesterly route to Redwood Creek with a confluence that would have been located on the west side of Muir Woods Road (Anderson et al. 2015). The current alignment is stable; no head cutting or grade control structures are required. Because of severe down-cutting of Redwood Creek, the channel elevation is substantially lower than historical elevations.

Within the monument, Redwood Creek is constrained by a narrow valley (NPS 2011c). Redwood Creek was channelized in the 1930s, and check dams and rock revetments were installed along approximately 57% of the stream within the monument (NPS 2014a). Natural hydrologic processes, including bank erosion, meandering, and flooding were altered because of the revetments on portions of Redwood Creek (NPS 2014a). The channelization resulted in channel widening (NPS 2011c). The revetments remain on portions of the creek; however, some check dams have been removed (NPS 2014a). Although some natural processes have returned, the creek has more riffle habitat and less deep water pool habitat than would naturally occur within a similarly sloped stream and less large woody debris (Fong 2002, as cited by NPS 2014a; NPCA 2009; NPS 2011c).

Streamflow in Redwood Creek can vary from very low during spring and summer to high and flashy during winter (Coopridier 2004; NPS 2011c). Measurements from 2003–2004 at the Muir Woods Road Bridge, at the downstream end of the project area, showed peak winter flows of about 30 to 170 cubic feet per second (cfs) (NPS 2011c). More recent measurements from a monitoring station on Redwood Creek about 1.5 miles downstream from the project area showed the daily discharge ranged from no flow to a maximum of 431 cfs (USGS 2016). Using a method that scaled peak flood flows at Redwood Creek near Tamalpais, streamflow was calculated for Redwood Creek about 330 feet upstream from the upstream project boundary. Streamflow from this method varied from 426 cfs to 1,864 cfs over a flood frequency range of 50% to 0.2% chance exceedance; peak flow estimates for Conlon Creek range from approximately 22 cfs for the two-year flood event to 175 cfs for the 500-year flood event (Anderson et al. 2015). Climate change models predict changes in the increases in the intensity and frequency of precipitation events and more frequent scouring floods, which could result in increased stormwater runoff and alterations to peak stream flows (NPS 2011c, 2014a).

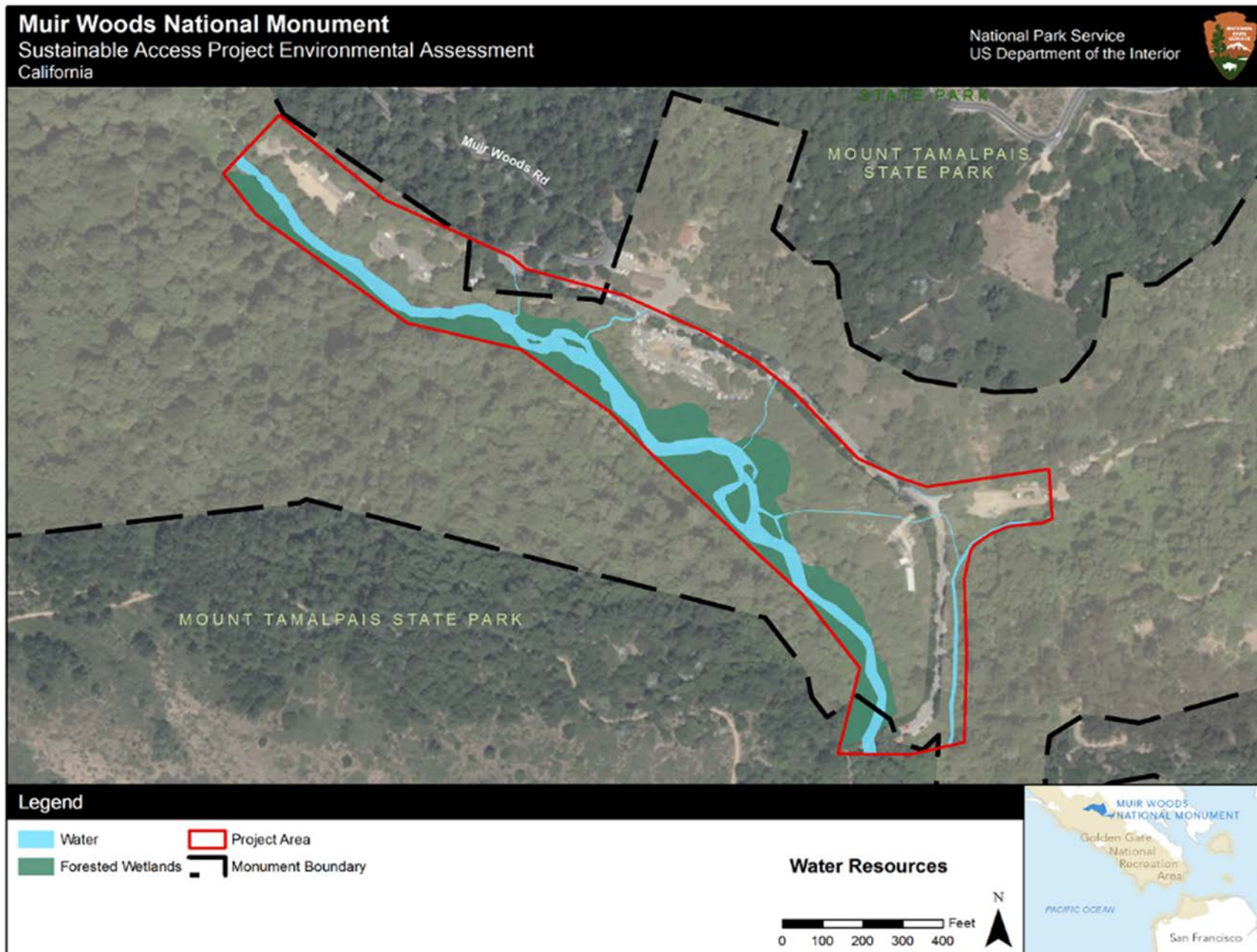


FIGURE 10: SURFACE WATER AND FORESTED WETLANDS

## Wetlands

The US Army Corps of Engineers (USACE) is charged with regulating the discharge of dredged or fill materials in wetlands or other “waters of the United States” under section 404 of the Clean Water Act. The US Army Corps of Engineers considers areas that are dominated by hydrophytic vegetation, contain hydric soils, and display indicators of hydrology to be a wetland. The NPS definition of wetlands is similar to that of the US Environmental Protection Agency and the US Army Corps of Engineers; however, the NPS definition is broader in scope and affords a greater jurisdiction than that of the US Army Corps of Engineers. The National Park Service classifies wetlands based on the USFWS Classification of Wetlands and Deepwater Habitats of the United States, also known as the Cowardin classification system (Cowardin et al. 1979). Based on the Cowardin classification system, a wetland must have one or more of the following attributes.

- The habitat at least periodically supports predominantly hydrophytic (wetland) vegetation.
- The substrate is predominantly undrained hydric soil.
- The substrate is nonsoil and saturated with water or is covered by shallow water at some time during the growing season (Cowardin et al. 1979).

Site-specific wetland delineations were conducted in the project area in January to March 2013 and in December 2015 (Ryan 2016). The surveys determined that Redwood Creek is a perennial stream that is permanently flooded and interspersed with intermittently flooded in-channel vegetated islands (Ryan 2016). Ryan determined that the tributaries were seasonally flooded and/or well-drained habitat (Ryan 2016). According to the Cowardin classification, five types of wetlands occur within the project area. Redwood Creek is classified as palustrine, forested, permanently flooded (PFOH), and its tributaries are palustrine, forested, seasonally flooded/well-drained (PFOD) or palustrine, forested, temporarily flooded (PFOA). Palustrine, forested, intermittently flooded (PFOJ) wetlands are adjacent to Redwood Creek between the Main and Annex Lots and much of the lower reaches of the creek. Palustrine, forested seasonally flooded/seasonally saturated wetlands (PFOE) are located adjacent to Muir Woods Road, approximately 75 feet southeast of the Annex Lot (figure 10) (Ryan 2016). This area is considered part of the historical floodplain. All other land was determined to be upland. The tributaries draining to Redwood Creek are classified as intermittent riverine habitats that are temporarily flooded (USFWS 2009).

## Water Quality

The *San Francisco Bay Basin (Region 2) Water Quality Control Plan* describes water quality standards for regional waterbodies. The standards include beneficial uses of waterbodies and the water quality objectives that protect these beneficial uses (San Francisco Bay RWQCB 2013). Redwood Creek has multiple possible beneficial uses including, but not limited to, agricultural, municipal, and domestic supply; freshwater replenishment; coldwater and warmwater habitat, fish migration and spawning, wildlife habitat, and preservation of rare and endangered species; shellfish harvesting; and contact or noncontact water recreation (San Francisco Bay RWQCB 2013; Wallitner 2016). These uses are for the entire length of the creek, not just the reach in the project area.

The San Francisco Bay Area Network Inventory and Monitoring Program monitors two sites close to the project area. One site is on the intermittent tributary, Camino del Canyon, and the other is on Redwood Creek at the bridge (Wallitner 2016). During the October 2013 to September 2014 monitoring cycle, Redwood Creek met water quality objectives most of the time (Wallitner 2016). The program measured water temperature, dissolved oxygen, pH, specific conductance, turbidity, nitrogen, and bacteria.

The core water quality parameters are temperature, dissolved oxygen, and pH. Water temperature in Redwood Creek was generally within the optimal temperature range (10 degrees Celsius [°C] to 15.6°C) for juvenile coho salmon with just a few short-term exceedances (Armour 1991; NPS 2011c; Wallitner 2016). Water temperature in Redwood Creek ranged from 8.5°C to 15.7°C; Camino del Canyon temperature samples were similar, ranging from 8.9°C to 13.7°C (Wallitner 2016). The lower limit was exceeded at least once during sampling of both streams, and the upper limit was exceeded at least once in Redwood Creek (Wallitner 2016). Climate change is expected to result in increased regional air temperatures of approximately 3°C to 6°C and droughts longer in duration (The Nature Conservancy 2009; NPS 2011c). Higher air temperature and drought conditions can result in lower streamflow and degrade water quality parameters, including surface water temperature (Georgakakos et al. 2014).

The San Francisco Bay Region Water Quality Control Board established a dissolved oxygen minimum of 7 milligrams per liter (mg/L) (San Francisco Bay Region Water Quality Control Board 2013). All dissolved oxygen measurements for 2013–2014 sampling were above this minimum. Redwood Creek had a wider range of dissolved oxygen measurements (7.53 mg/L to 11.43 mg/L) than those in Camino del Canyon (10.15 mg/L to 11.43 mg/L) (Wallitner 2016). The mean dissolved oxygen value for Camino del Canyon was the second highest for the 2013–2014 sampling program (Wallitner 2016), and pH measurements for both streams were well within the standard of 6.5 to 8.5 and ranged from 7.22 to 8.08 (Wallitner 2016).

The San Francisco Bay Region Water Quality Control Board does not specify criteria for specific conductance; however, to support diverse aquatic communities in freshwater streams, specific conductance should be below 500 microsiemens per centimeter ( $\mu\text{S}/\text{cm}$ ) (Behar 1997, as cited by Wallitner 2016). Specific conductance values ranged from 121.3  $\mu\text{S}/\text{cm}$  to 264.9  $\mu\text{S}/\text{cm}$  in Redwood Creek and 156.8  $\mu\text{S}/\text{cm}$  to 219.8  $\mu\text{S}/\text{cm}$  in Camino del Canyon.

Turbidity levels of up to 41.1 nephelometric turbidity units (NTU) and 134 NTU were recorded in Redwood Creek and Camino del Canyon, respectively, and exceeded the 25 NTU ecological objective (NPS 2016g; Wallitner 2016). The mean turbidity level of 39.8 NTU for Camino del Canyon was one of the highest for the 2013–2014 program year (Wallitner 2016). Median values were much lower at 0.46 NTU and 9.61 for Redwood Creek and Camino del Canyon, respectively, providing evidence that the high turbidity levels do not persist over long periods. Erosion of upstream roads and culverts results in sedimentation in the reach of Redwood Creek in the monument (NPS 2014a). Channel incision in the monument results in sediment loading in the downstream portions of Redwood Creek (NPS 2014a). Changes in the intensity and frequency of precipitation events and more frequent flooding associated with climate change could result in increased stormwater runoff and therefore increased levels of pollutants and soil erosion (NPS 2011c).

Water quality criteria for nitrate does not exist; however, an ecological threshold of 0.30 mg/L is frequently used as the threshold to limit eutrophication in streams (Roche et al. 2013, as cited by Wallitner 2016). Nitrate as nitrogen was low in Redwood Creek, ranging from less than 0.15 mg/L to 0.33 mg/L with 17 of 21 samples reporting levels below the detection limit (Wallitner 2016). All samples for nitrate as nitrogen in Camino del Canyon were above the 0.30 mg/L ecological threshold; the samples ranged from 0.35 mg/L to 2.7 mg/L with a mean of 1.09 mg/L, the highest mean recorded during the 2013–2014 sampling (Wallitner 2016). The regional reference value of 0.36 mg/L for total Kjeldahl nitrogen was exceeded in many of the samples especially in Camino del Canyon (USEPA 2000; Wallitner 2016). Redwood Creek samples ranged from less than 0.25 mg/L to 0.63 mg/L and had the lowest mean of 0.33 mg/L. Similar to nitrate as nitrogen, Camino del Canyon had higher levels of total Kjeldahl nitrogen with a mean of 0.51 mg/L and a range 0.29 mg/L to 1.0 mg/L (Wallitner 2016).

## **Floodplains**

Federal Emergency Management Agency flood maps do not identify any floodplains within the monument (FEMA 2009). However, some areas are designated as “areas in which flood hazards are undetermined, but possible” (FEMA 2009). Areas along Redwood Creek are part of an erosion hazard or channel migration area that encompasses portions of two parking lots, a trail, and two small buildings, although records do not indicate that any monument structures have been flooded (ESA 2014; NPS 2014a). The estimated channel migration area ranges from approximately 25 feet wide at the upstream end of the project area to 206 to 225 feet in the middle reaches and to 128 feet at the downstream end (ESA 2014).

The project area historically contained floodplains located on abandoned terraces of Redwood Creek (ESA 2014; Ryan 2016). These floodplains of Redwood Creek within the monument have been altered through streambank stabilization structures, dams, and fill placement (NPS 2014a). Much of Redwood Creek within the monument is held within more rigid banks by these structures and not allowed to meander and flood historical floodplain areas, except for the reaches adjacent to the Nursery and Annex Lots (ESA 2014; NPS 2014a). Streambed incision has also contributed to the creek being hydrologically disconnected from its historical floodplains, which are now located on terraces above the stream channel (Ryan 2016). Preliminary analysis has shown that the current channel is likely to contain a 100-year flood event (ESA 2014). Two-year peak flows were estimated at 180 to 260 cfs, and 100-year peak flows were estimated at 880 to 1,500 cfs (Kimball and Kondolf 2002). Occasional flash floods occur in winter when stormwater runoff is more intense (NPS 2014a). Various climate models project either increases or decreases in regional precipitation by 2080; however, flood events are expected to increase, including scouring events (NPS 2011c, 2014a; Walsh et al. 2014). Based on available climate change information, the expected future state of hydrology would change such that storm intensity and frequency would increase (NPS 2011c, 2014; Walsh et al. 2014). These alterations to storms and heavy precipitation events would change the inundation areas for a 100-year flood event (NPS 2014a).

## **THREATENED AND ENDANGERED SPECIES**

The monument provides habitat for four federally listed threatened and endangered species. Threatened and endangered species known to occur or which may occur within the boundaries of the monument include coho salmon, steelhead trout, northern spotted owl, marbled murrelet, and California red-legged frog. Information about each of these species, including federal and state status, occurrence at the monument, and primary threats is provided below.

### **Coho Salmon**

Coho salmon is listed as endangered at both the federal and California state levels. Coho salmon is an anadromous fish species, meaning that they begin their life cycle in freshwater environments and migrate to marine environments in their adult stage. Redwood Creek, which flows through the monument before eventually discharging into the Pacific Ocean at Muir Beach, has been designated as critical habitat for coho salmon. Redwood Creek has also been identified as “a high priority restoration area for coho salmon” under the California Department of Fish and Game’s 2004 Recovery Strategy (CDFG 2004). Redwood Creek is one of the last streams in California with remaining native stocks of coho salmon. Coho salmon require silt-free gravel substrate, consistent water temperature, and deep pools for spawning (NPS 2014a).

Coho salmon found in Redwood Creek are part of the Central California Evolutionarily Significant Unit, found in three watersheds in the NPS San Francisco Bay Area Network (NPS 1999). However,

genetic analysis shows that the coho salmon in Redwood Creek is a genetically distinct subgroup than other populations within the same evolutionarily significant unit (NPS and Marin County 2007). Spawning typically occurs between December and February, and juveniles emerge in March and April. Juveniles remain in fresh water for approximately 15 months before migrating to the Pacific Ocean (NPS and Marin County 2007).

The section of Redwood Creek within the project area provides habitat for spawning salmon, but the habitat for juvenile salmon is limited because of the loss of pools that resulted from previous creek alterations. Coho salmon populations can be greatly affected by floods, droughts, and other unpredictable events, which can jeopardize the survival of an entire year's spawning population. Coho salmon are also very sensitive to changes in temperature and therefore may be significantly affected by climate change (NPCA 2011). Over the last century, the maximum, mean, and minimum air temperatures in the central California coastal region have increased by 1°C. Stream temperature is directly correlated with air temperature. Thus, rising water temperature has affected many central California streams that support or have historically supported coho salmon populations, including Redwood Creek. Concurrently, average precipitation and streamflow have decreased (Madej 2010). In 2006, researchers counted lower numbers of juvenile coho per pool than average in Redwood Creek. During 2007–2008, no returning adult coho were observed in Redwood Creek (NPCA 2011). Only remnant coho salmon populations remain in Redwood Creek and are at or near extirpation (CDFW 2015).

Throughout its range, the coho salmon population has declined because of overfishing, loss of freshwater and estuarine habitat, hydropower development, poor ocean conditions, and hatchery practices (NMFS 2016). However, observed data trends suggest that climate change will increasingly threaten the viability of coho salmon populations and habitats in the future (Madej 2010).

### **Steelhead Trout**

Steelhead trout is listed as a threatened species at the federal level. Like coho salmon, steelhead trout is an anadromous species. Within the boundaries of the monument, steelhead trout are present in Redwood Creek, which has been designated as critical habitat for this species. Steelhead trout has similar habitat requirements to coho salmon (NPS 2005). Habitat preferences for juvenile steelhead trout are deep pools created by rootwads and boulders in heavily shaded stream sections, although steelhead trout less than one year of age are often forced into shallow-water habitats. Although Redwood Creek has historically provided good spawning habitat for steelhead trout, loss of pools because of previous creek alterations has reduced the availability of preferred habitat for this species (NPCA 2011). Spawning typically occurs in late winter or spring. The amount of time steelhead trout rear in freshwater and marine/estuarine habitats varies, ranging between one to three years (NPS 2014a). Unlike other species of salmon, steelhead trout do not necessarily die after spawning and are able to spawn more than once (USFWS 2016).

Causes of decline for steelhead trout are the same as for coho salmon—overfishing, habitat loss and degradation, and climate change (NPCA 2011). Increased air and stream temperatures, as well as reduced precipitation and stream flows, are stressors affecting this species. These data trends suggest that climate change is an increasing threat to steelhead trout populations (Madej 2010).

### **Northern Spotted Owl**

The northern spotted owl is listed as a threatened species at the federal level. Marin County supports the highest known density of northern spotted owls throughout its range, estimated to be around 75 pairs. This population is geographically isolated from northern spotted owl populations to the

north, and gene flow between populations is limited (NPS 2005). This species is known to reside and breed within the boundaries of the monument, which is located at the southernmost extreme of the species' range. Although the monument was home to two pairs of northern spotted owl when monitoring began in 1999, northern spotted owls have not established an activity center within the boundaries of the monument since 2010 (Ellis 2016). However, they may still use sites within the monument for feeding, nesting, or roosting. This species most commonly nests in old coast redwood trees and Douglas fir (*Pseudotsuga menziesii*) trees (NPCA 2011).

Although loss of habitat because of development is a concern throughout much of its range, the US Fish and Wildlife Service has identified competition with the barred owl (*Strix varia*) as the primary threat to the northern spotted owl (USFWS 2011). Barred owls have been shown to display aggressive behavior toward northern spotted owls, sometimes leading to displacement of individuals or nests. This has become an increasing threat to northern spotted owls because barred owl range and population size have expanded in recent decades (Kelly et al. 2003). Barred owls are known to nest at the monument and are suspected to be the main driver of decline in the northern spotted owl population both inside and outside the boundaries of the monument.

### **Marbled Murrelet**

The marbled murrelet is listed as threatened at the federal level and endangered at the California state level. This Pacific seabird nests in old-growth forests but spends most of its life in marine environments (USFWS 1997). While suitable marbled murrelet habitat has been identified in the monument, this species has not been documented at the monument (NPCA 2011). Loss of nesting habitat, primarily because of timber harvest and wildfires, has been identified as the primary threat to this species (USFWS 1997). Shifts in marine food webs from climate change are also expected to affect marbled murrelet populations in the future (USFWS 2012).

### **California Red-Legged Frog**

The California red-legged frog is listed as threatened at the federal level. This aquatic frog breeds in ponds and slow-moving streams and is associated with emergent vegetation. This species has not been identified at the monument but has been documented in small, human-made ponds adjacent to Redwood Creek, approximately 1.6 miles downstream of the project area. Throughout its range, habitat loss, degradation, and modification are the primary threats to this species (NPS 2016h).

## **CULTURAL RESOURCES**

### **Area of Potential Effects**

As required under section 106 of the National Historic Preservation Act of 1966, an area of potential effects must be established to determine and define the “geographic area or areas within which an undertaking may directly or indirectly cause alterations to the character or use of historic properties, if such properties exist and is influenced by the scale and nature of an undertaking. It encompasses both those areas where proposed actions might occur that would directly impact cultural resources, as well as adjacent areas that contain resources that might be indirectly affected” (36 CFR 800.16(d)).

To assess the effects of this undertaking on all historic resources that might be affected, the area of potential effects includes the entire Muir Woods Historic District. The areas that the project would directly affect are the monument entrance area, existing parking areas, and any proposed new parking areas. A detailed map of the area of potential effects, including known resources and areas of indirect impact, is shown in figure 11.



## Properties Listed in the National Register

**Muir Woods National Monument.** The monument is one of the great examples of the early development of the conservation movement in the late 19th and early 20th centuries to preserve an old-growth forest of coast redwoods. Theodore Roosevelt declared it a national monument in 1908 under the provisions of the Antiquity Act of 1906. The portion of the monument as it existed at the end of the period of significance (1907–1947) was entered into the national register in 2008 as a historic district. For a property to be eligible for the national register, it must meet at least one of four main criteria.

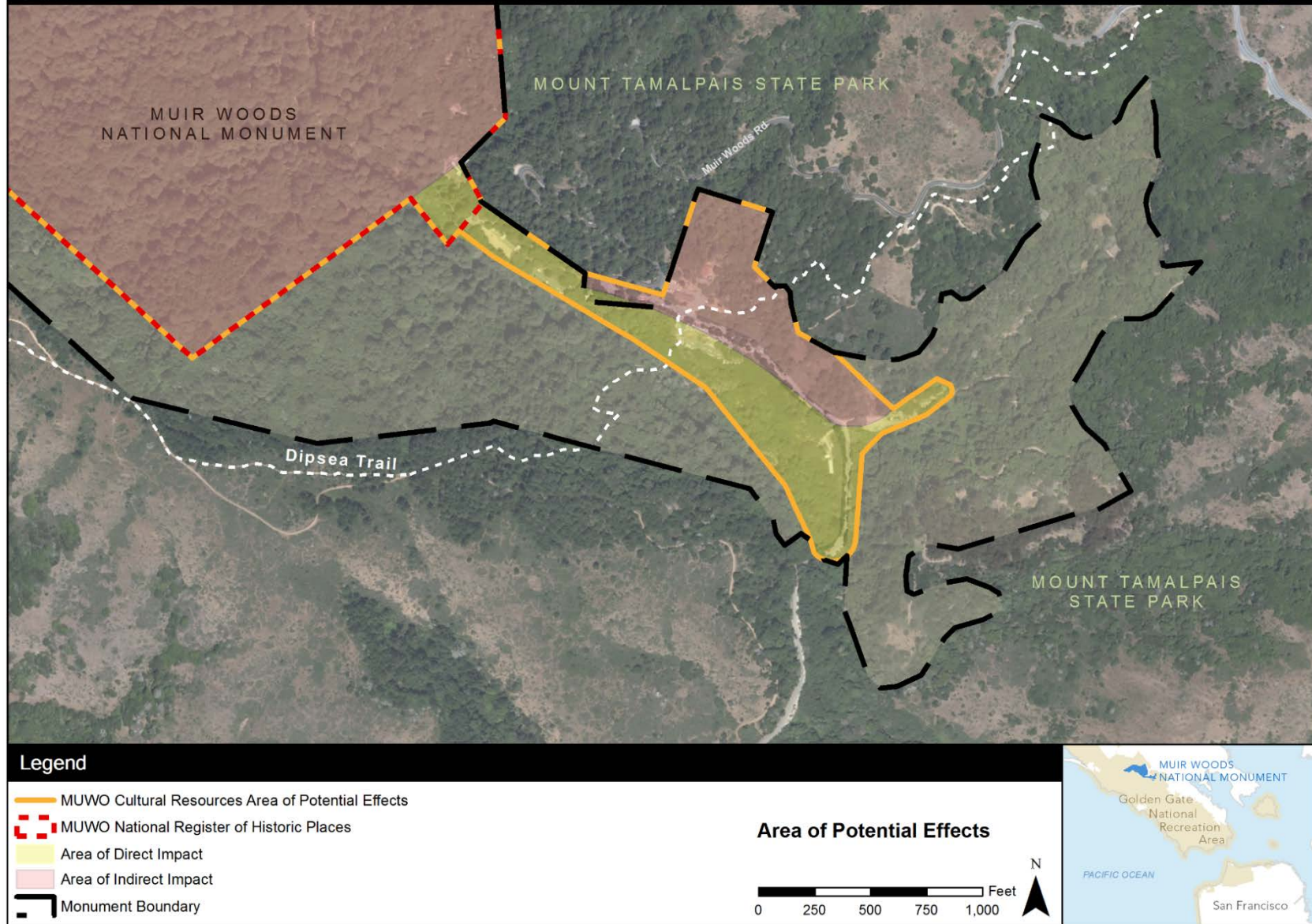
- **Criterion A.** The property is associated with events that have made a significant contribution to the broad patterns of our history; or
- **Criterion B.** The property is associated with the lives of persons significant in our past; or
- **Criterion C.** The property embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; or
- **Criterion D.** The property has yielded or may be likely to yield, information important in prehistory or history.

The monument was found to be nationally significant under criterion A and criterion C for the contributions of William Kent and the conservation movement, its use of rustic park architecture, and as an example of Emergency Conservation Work / Civilian Conservation Corps programs in the 1930s. Five buildings and 22 structures (dating 1922–1940) are significant under Criterion C as representative examples of pre-World War II-era rustic design characteristic of NPS buildings built during that era.

**Dipsea Trail.** The Dipsea Trail extends from the town of Mill Valley, over Mount Tamalpais, to Stinson Beach, and is the course for the Dipsea Race, the oldest cross-country trail race in the country. In 2010, the trail was listed in the national register for the Dipsea Race's influence on the development of other foot races and as a manifestation of America's concern for physical fitness (criterion A). Significant built features include the trail bed, 19th century roadbeds, wooden bridges and steps, and stone steps.

## Properties with a Formal Determination of Eligibility for the National Register

**Camino Del Canyon.** The Camino Del Canyon tract was added to the monument as a buffer zone to protect the Redwood groves and the visitor experience in the monument. This area is not within the Muir Woods Historic District. It includes the Conlon Lot, which is within the area of potential effects. In 2007, the monument submitted a determination of eligibility for the area. One property within the tract was found to be eligible for listing in the national register—the Hillwood Camp. This property is outside the zone where visual or auditory impacts are expected and was excluded from the area of potential effects.



**FIGURE 11: AREA OF POTENTIAL EFFECTS**

**Parking Lot Tract.** Just outside the monument entrance, the Parking Lot Tract was excluded from the Muir Woods Historic District because it was not a part of the monument during the period of significance and because of a loss of historic integrity resulting from modern alterations and additions from the construction of parking lots.

**Muir Woods Inn.** The Muir Woods Inn site was initially surveyed by Faith Duncan in 1988 and recorded as part of site form CA-MRN-568H. It was further evaluated in 2015 and submitted to the California State Historic Preservation Office in early 2016. The site consists of the former Muir Woods Inn and various outbuildings, including a restroom facility, two small cabins, and an architecturally undistinguished house built in 1965 after the period of significance, by the Schlette family, the last owners of the Inn.

The Muir Woods Inn and outbuildings are located on the north side of Muir Woods Road, directly across from the Annex Lot. Joe Landgraff originally built the inn around 1930 as a refreshment shop, which he named Coffee Joe's. In 1945, Coffee Joe's was sold to the Schlette family, who renamed it the "Muir Woods Inn." The National Park Service acquired the property in 1972 and the inn was subsequently remodeled on the interior and exterior. It now serves as an office, storage space, a small machine shop, and a conference room for the monument. The National Park Service determined that the building was not eligible for the national register because it is highly altered and lacks the necessary physical elements required under the national register. The California State Historic Preservation Office concurred with this finding by letter on July 6, 2016.

## Archeology

An archeological survey was conducted within the project area, along the northeastern side of Redwood Creek between the creek and Muir Woods Road. The 10-acre survey began near the Annex Lot, continued southeast along Muir Woods Road to the bridge crossing and then back up to the Annex Lot along Redwood Creek. The survey documented two new historic sites and one historic isolated find. One of the newly recorded historic sites, CA-MRN-723H, is outside the project area.

The other historic site, CA-MRN-722H (the Annex Lot) is within the project area. Several factors suggest that the site is eligible under criterion D, because it has yielded, and may be likely to further yield, information important to early 20th-century public recreation and tourism at Muir Woods. Two other areas within the direct area of potential effects have a high potential for as yet unknown subsurface deposits: the former Nursery Area and the Conlon Lot, which are the former locations of the Second Lodge of Camp Kent (1910–1924), and the original Camp Kent campgrounds (1898–1923), respectively.

## Tribal Consultation

To date, the Federated Indians of Graton Rancheria have not indicated that properties of traditional cultural value associated with this project or within the area of potential effects exist. Following consultation on February 2 and March 29, 2016, and a walk through the area of potential effects on June 6, 2016, the tribal representative stated that the tribe had no formal comments on the Sustainable Access Project.

## **CHAPTER 4: ENVIRONMENTAL CONSEQUENCES**

### **GENERAL METHODOLOGY FOR ESTABLISHING IMPACTS**

In accordance with CEQ regulations, direct, indirect, and cumulative impacts are described (40 CFR 1502.16) and the impacts are assessed in terms of context and intensity (40 CFR 1508.27). Where appropriate, mitigating measures for adverse impacts are also described and incorporated into the evaluation of impacts. A full list of mitigation measures can be found in “Chapter 2: Alternatives.”

### **CUMULATIVE IMPACTS ANALYSIS METHODOLOGY**

Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions” (40 CFR 1508.7/8). The temporal scale for the cumulative impacts analysis includes past actions from the reservation system through reasonably foreseeable future actions.

Cumulative impacts are determined for each impact topic by combining the impacts of the alternative being analyzed and other past, present, and reasonably foreseeable actions that would also result in beneficial or adverse impacts. Because some of these actions are in the early planning stages, the evaluation of cumulative impacts is based on a general description of the projects. Other past, present, and reasonably foreseeable actions located near the monument to be included in the cumulative impacts analysis were identified through the internal and external project scoping processes and are summarized below.

#### **Muir Woods Reservation System**

Phase 1 of the reservation system established a parking barrier system along Muir Woods Road. This system involved placing posts and cables along the narrow Muir Woods Road shoulder to improve traffic safety and prevent parking along the shoulder. Approximately a mile of the post system with reflective markers was installed both north of the monument entrance and south towards Kent Canyon. White edge striping was added to the roadway to better define the pavement edge. Additional no parking signage and erosion and sediment control measures were also installed. The construction of this project was completed at the end of February 2016. Figure 12 shows the installed posts and erosion control measures in place.

Phase 2 of the reservation system will reduce peak visitations at the monument by managing motorized vehicle access and allowing monument staff to control parking both within the monument’s lots and on Muir Woods Road (which is owned and managed by Marin County). The reservation system includes two separate, but coordinated systems. Reservations for privately owned vehicles and for the Muir Woods Shuttle will be made directly through a reservation system operated by a third-party operator. Commercial carriers will be required to obtain a reservation for one of the parking spaces designated for commercial carrier use through another, separately managed system. The reservation system will also ensure that parking on the Muir Woods Road shoulder will not initially exceed 80 vehicles south of the Muir Woods Road Bridge (NPS 2015d). By 2021, no vehicles will be allowed to park on the shoulder south of the bridge.





SOURCE: NPS

**FIGURE 12. POST INSTALLATION AND EROSION CONTROL MEASURES**

### **Muir Woods Road Bridge Replacement Project**

Marin County received federal funding to replace local bridges that were identified as structurally deficient and functionally obsolete. Muir Woods Road Bridge is one of the bridges identified for replacement, and a project was recently initiated to conduct environmental studies and begin design work. High priorities for the project are to protect riparian habitat and maintain traffic flow.

Muir Woods Road Bridge is located just south of the monument boundary. The existing bridge was built in 1946 and is a single-span, reinforced concrete T-beam structure. The bridge needs to be replaced for the following reasons:

- The structure has deficiencies in the structural concrete and structural steel.
- The existing bridge alignment does not meet current road geometry standards.
- Bridge railings do not meet current safety standards.
- Scour from the creek has caused undermining of the structure.

The project improvements are anticipated to extend from 400 feet west of the bridge to 600 feet east of the bridge along Muir Woods Road, which would involve realigning the roadway to correct the current “S” curve. Access to the monument would be maintained at all times. The design stage for this project is expected to begin in 2017 with construction anticipated in 2019.

### **Muir Woods Road Rehabilitation Project**

Through a Federal Land Access Program Grant, this project will repair road slides at various locations. Approximately 36 culverts, 2 of which are located in the project area, will be repaired or

replaced to decrease sediment loading into Redwood Creek. As part of this project, 2.48 miles of new asphalt will be resurfaced along Muir Woods Road. The planning stage for the project is expected to be completed in 2017, and construction is likely beginning in 2020 (NPS 2015f).

### **Muir Woods Water and Wastewater Rehabilitation Project**

The monument is planning to rehabilitate water and wastewater lines and critical components of its potable water system and wastewater collection systems. The project would provide reliable services at the monument to meet current codes for water and wastewater collection services, address fire flow demands, resolve potable water quality issues, improve visitor and employee health and safety, and locate wastewater infrastructure out of the Redwood Creek corridor (NPS 2017a). Construction for this project is expected to begin in summer 2018 and be completed in winter 2018.

### **Redwood Creek Trail Realignment and Dias Ridge Trail Extension Project**

The National Park Service and the California Department of Parks and Recreation are proposing to improve or modify trails within the Redwood Creek Watershed. This project would reconstruct the existing Redwood Creek Trail segment between Muir Woods Road and the Miwok Trail, decommission and replace the existing segment of the Redwood Creek Trail from the Miwok Trail to Santos Meadow, improve the trail tread from Santos Meadow to the southern trailhead, and construct an extension of the Dias Ridge Trail from Golden Gate Dairy on Highway 1 to the Redwood Creek Trail's southern trailhead (NPS 2015g). These actions would improve trail conditions and safety for visitors, reduce sediment loads and improve water quality in Redwood Creek, provide a trail interconnection, and reduce trail maintenance requirements. The project would be constructed in four phases over four years, likely beginning in 2020 or 2021.

### **Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project**

The Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project would restore habitat in Redwood Creek for aquatic life, including the federally threatened coho salmon, and replace aging pedestrian bridges at the monument (NPS 2017b). As part of this project, selected large boulders (i.e., riprap) that were placed on the banks of Redwood Creek more than 80 years ago to stabilize the stream bank would be removed. Following the riprap removal, large woody debris would be installed in the creek. These two actions would significantly improve the conditions needed to help young fish survive. Four aging pedestrian bridges on Redwood Creek that are reaching the end of their lifespan would also be replaced. The new bridges would provide accessible creek crossings and be designed with a longer span and more durable materials to improve both public safety and enhance the way water flows in the creek to support ongoing habitat restoration efforts. The project is anticipated to begin in 2018 and be completed in 2020.

## **VISITOR EXPERIENCE AND SAFETY**

### **Methodology and Assumptions**

The analysis of visitor experience and safety was based on reviewing the visitation demand forecast to determine future visitation to the monument and the resulting potential increase in traffic that would need to be accommodated. The analysis considered the following elements:

- implementing measures to ensure visitors do not experience crowded conditions by managing user capacity
- evaluating the visitor arrival, entrance, and departure experience at the monument

- addressing wayfinding to assist visitors in finding parking lots and navigating the trail system
- evaluating amenities available to visitors
- evaluating the availability and location of ABA-compliant parking spaces
- assessing the availability of interpretive and educational opportunities that prepare visitors for their experience at the monument
- evaluating emergency access and circulation to ensure emergency personnel can quickly access facilities at the monument

Each of these elements are evaluated under the three alternatives. Visitor safety covering vehicle to vehicle and vehicle to pedestrian conflicts are covered in the “Transportation” section.

### **Impacts of Alternative 1: No Action**

**Analysis.** Under alternative 1, the reservation system will alter the arrival, entry, and departure experience; therefore, impacts on visitor experience under the no-action alternative are most accurately described under “Cumulative Impacts.” The remaining impacts on visitor amenities and visitor experience with respect to wayfinding, interpretive and educational opportunities, and emergency circulation and access are discussed in this section.

Under alternative 1, the existing undersized restroom situated within the viewshed of Redwood Creek between the Entry Plaza and Main Lot would remain in place. The restroom would not accommodate peak visitation levels and would remain a long walk from some of the parking locations, resulting in continued direct, long-term, adverse impacts on visitor amenities.

Visitors would also continue to use the Muir Woods Road pedestrian trail to access the Entry Plaza from the Annex and Conlon Lots and from roadside parking. These visitors would continue to cross a maximum of three driveways. Vehicle-pedestrian conflicts and safety concerns would be ongoing.

Interpretive and educational opportunities preparing visitors for their experience would continue to be available only at the Dipsea Trailhead. Therefore, impacts on the visitor experience (i.e., wayfinding and interpretive and educational opportunities) would be direct, long term, and adverse—reflecting the status quo for these visitor experience components.

Emergency access and circulation would continue to conflict with pedestrians in the Entry Plaza and could potentially encounter delays from privately owned vehicles and buses parking in the Main Lot and navigating narrowed roadways caused by shoulder parking along Muir Woods Road. Therefore, impacts on visitor safety from emergency access and circulation would be direct, long term, and adverse, reflecting the mix of buses, privately owned vehicles, and pedestrians in the Main Lot and Entry Plaza and shoulder parking along Muir Woods Road.

**Cumulative Impacts.** Phase 1 of the reservation system reduced shoulder parking along Muir Woods Road south of the Muir Woods Road Bridge to 80 designated spots, which limits the number of visitors who can arrive by privately owned vehicle and improves safety for both pedestrians and vehicles traveling along sections of Muir Woods Road that had previously accommodated shoulder parking. Until the reservation system is implemented in 2017, the reduced parking availability will cause indirect, short-term, adverse impacts for those visitors who are unable to find parking. Phase 2 of the reservation system will also limit the total number of visitors to the monument by implementing a parking reservation system for privately owned vehicles and commercial buses and shuttles. The reservation system will reduce the peak historical number of visitors entering and exiting the monument and the number of pedestrians walking the trails to the Entry Plaza at any given time. The visitor arrival, entry, and departure experience will improve as a result of assigning

specific time frames for each vehicle to park at the monument, especially during peak times, which will reduce visitor congestion when finding parking and manage visitation levels to be within the user capacity. The reduction in the number of visitors will result in less strain on the aging and undersized visitor support facilities; the reduction in shoulder parking along Muir Woods Road will improve emergency vehicle access. Therefore, this action will result in direct and indirect, long-term, beneficial impacts on visitor experience and safety.

The Muir Woods Road Bridge Replacement Project would involve the replacement of an existing structure and may require the pedestrian crossing to be temporarily closed. The project would result in direct, short-term, adverse impacts on visitor experience and safety because pedestrians would need to walk in the travel-way to cross the bridge during the construction period and emergency vehicles may be delayed when attempting to cross the bridge.

The Muir Woods Road Rehabilitation Project would entail resurfacing portions of Muir Woods Road and could cause an inconvenience if visitors have to drive along an unpaved roadway or cross the street at a temporary striped crosswalk. Therefore, the project would result in direct, short-term, adverse impacts on visitor experience and safety during the construction period.

The Muir Woods Water and Wastewater Service Rehabilitation Project would involve the installation of new water and sewer lines connecting the former Nursery Area to the visitor center. The lines would travel through the Annex Lot, Main Lot, and Entry Plaza. This connection would run parallel to but not within the roadbed of Muir Woods Road. The project would be coordinated with Marin County and the Muir Woods Road Rehabilitation Project to minimize adverse impacts. During construction, impacts on visitor experience and safety would be direct, short term, and adverse. Construction could potentially affect the arrival and departure experience from temporary parking lots and trail closures.

The Redwood Creek Trail Realignment and Dias Ridge Trail Extension Project would result in direct, short-term, adverse impacts on visitor experience during construction because existing trail segments may be closed as they are repaired or replaced, requiring visitors to follow an alternative route. However, the project would improve trail conditions and provide safer conditions for visitors, resulting in direct, long-term, beneficial impacts on visitor experience and safety.

The Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project would involve replacing existing pedestrian bridges that are in poor condition, providing visitors an opportunity to use new safer bridges; therefore, the project would result in direct, long-term, beneficial impacts on visitor experience and safety. During the construction phase, this project would result in direct, short-term, adverse impacts on visitor experience and safety because the trail could be closed, requiring visitors to follow an alternative route.

Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would result in direct, short-term, adverse and direct, long-term, beneficial impacts on visitor experience and safety. When the continued adverse impacts of alternative 1 are combined with the effects of cumulative actions, an overall long-term, beneficial cumulative impact on visitor experience and safety is expected.

**Conclusion.** Under alternative 1, the condition of amenities, the lack of wayfinding and interpretive and educational opportunities, and emergency access and circulation patterns would not be improved and would continue to have long-term, adverse impacts on visitor experience and safety.



Limited, short-term, adverse cumulative impacts on visitor experience and safety would occur during the construction period of the cumulative actions and long-term, beneficial impacts from reduced congestion in parking lots, along Muir Woods Road, and on the trail system to Muir Beach. While parking congestion would be alleviated by the full implementation of the reservation system, poor wayfinding on the existing trail network to the Entry Plaza, undersized restroom facilities, and limited interpretive and educational opportunities would continue to detract from the visitor experience. Vehicle-pedestrian safety conflicts would continue; however, the reduction and eventual elimination of all but 30 roadside parking spaces and implementation of the reservation system will reduce the number of both cars and pedestrians entering the monument and improve safety. The impacts of the cumulative actions would be beneficial; however, impacts from alternative 1 would be adverse. The contribution of alternative 1 to cumulative impacts would be minimal; therefore impacts on the arrival, entry, and departure experience; visitor amenities; wayfinding; and interpretive media would result in an overall beneficial cumulative impact.

### **Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements**

**Analysis.** Under alternative 2, the arrival, entry, and departure experience would be modified from current conditions to include (1) a second restroom facility located near the former Nursery Area, (2) relocation of the restroom facility in the Entry Plaza away from Redwood Creek to enhance the arrival experience and remove it from the Redwood Creek viewshed, (3) noticeable separation between the parking areas and Entry Plaza, (4) fewer vehicles attempting to navigate the Main Lot while visitors walk between buses and the Entry Plaza, and (5) a new footbridge crossing Redwood Creek along the Dipsea Trail. Privately owned vehicles with handicap placards would no longer park in the Entry Plaza, which would provide a quieter experience for visitors as they approach the forest and a more scenic transition from the parking area to the forest. Visitors arriving by bus or shuttle would continue to arrive and depart from the Main Lot; however, privately owned vehicles without a handicap placard would no longer be allowed to park in this lot. Similar to alternative 1, safety would continue to be inadequate for visitors on their way to the Entry Plaza. Pedestrians would continue to use the Muir Woods Road pedestrian trail to access the Entry Plaza from the Annex and Conlon Lots, as well as from roadside parking locations. These pedestrians would cross a maximum of two driveways, which would maintain existing vehicle-pedestrian conflicts.

A new footbridge constructed on the Dipsea Trail would provide a safe river crossing year-round and an additional wayside area for visitors on their walk toward the monument. As a result, impacts on the arrival, entry, and departure experience would be direct, long term, and beneficial from fewer vehicle conflicts in the Main Lot and Entry Plaza, but pedestrian-vehicle conflicts from roadside parking and Conlon and Annex Lots would also continue long-term, adverse impacts.

Two restroom facilities would be available for visitors. The existing restroom in the Entry Plaza would be relocated within the plaza, away from Redwood Creek, to provide visitors with an enriched experience by opening up a new view of Redwood Creek. A second restroom would be added near the former Nursery Area to provide a restroom option closer to parking locations for privately owned vehicles and be available to Dipsea Trail users. Providing a second restroom would reduce the number of visitors who choose the facility situated at the Entry Plaza and reduce the distance between the parking areas and nearest restroom facility. Therefore, impacts on visitor amenities would be direct, long term, and beneficial.

Wayfinding and interpretive media would be installed to help visitors find trails leading to the forest and communicate the history of the monument. Additional signage would direct visitors from the parking areas to the Entry Plaza and other trails. Interpretive media would be provided along the trail

connecting the Annex and Main Lots for educational purposes. Additional signage would improve wayfinding, reduce visitor confusion, and provide visitors with a greater understanding of the history and context of the monument. It would also guide visitors to assure them they are on the right path and keep them out of the roadway, reducing pedestrian-vehicle conflicts. New interpretive and educational opportunities also would be provided in the Entry Plaza to prepare visitors for their experience of the monument. Together, these changes in wayfinding, interpretive media, and educational opportunities would have direct, long-term, beneficial impacts on visitor experience.

ABA-compliant parking would be shifted from the Entry Plaza to the Main Lot, which is farther from the monument entrance compared to existing conditions. While 11 parking spots are currently available in the Entry Plaza for ABA-parking, only 9 of those spots are ABA-compliant. The Main Lot would not have any parking for privately owned vehicles without a handicap placard, but all 11 parking spots would be ABA-compliant. Therefore, those parking in ABA-compliant spaces would encounter safer conditions with no privately owned vehicles circulating through the Main Lot. Impacts on ABA-compliant parking would be direct, long term, and beneficial, reflecting safer conditions in the Main Lot and entry experience for those who park in ABA-compliant spaces. However, impacts on ABA-compliant parking could also be direct, long term, and adverse, considering the added distance to walk to the monument entrance.

Alternative 2 would provide more room for emergency vehicles access to the Entry Plaza because privately owned vehicles would no longer be permitted. Therefore, impacts on visitor safety from emergency vehicles access in the Entry Plaza would be direct, long term, and beneficial. Changes to Annex and Conlon Lot circulation patterns would be improved, providing a loop pattern served by one driveway for the Annex Lot and wider travel aisle for the Conlon Lot. Impacts on visitor safety from these circulation changes would be direct, short and long term, and beneficial because of wider travel-ways and counter-clockwise loop designs, which provide for safer driving conditions and improved access for emergency vehicles.

During the construction period for alternative 2, the staging of construction equipment would affect the visual character of the monument grounds; construction noise would affect the soundscape; and the displacement of existing parking when the parking lots are reconfigured would disturb typical arrival and departure patterns. Therefore, implementation of alternative 2 would also result in direct, short-term, adverse impacts on the visitor arrival, entry, and departure experience. Mitigation measures described in chapter 2 would minimize the adverse impacts to the extent possible during the construction period.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 2 would result in direct, short-term, adverse and direct, long-term, beneficial impacts on visitor experience and safety and continued long-term, adverse impacts on visitor safety. When the beneficial and adverse impacts of alternative 2 are combined with the beneficial effects of cumulative actions in the project area, an overall long-term, beneficial cumulative impact on visitor experience and safety is expected.

**Conclusion.** Under alternative 2, the existing visitor experience would be improved by removing privately owned vehicles from the Entry Plaza, reducing the Annex Lot driveways from two to one, improving wayfinding, adding new interpretive media at the Entry Plaza and along the Redwood Creek trail, increasing the number of ABA-compliant parking spaces, adding a new restroom facility, relocating the existing Entry Plaza restrooms, and removing privately owned vehicle parking spaces from the Main Lot. These improvements would ensure that visitors have access to key amenities, such as restrooms closer to their parking location and can easily locate and use the correct trail to

safely walk to the Entry Plaza. Visitors would also benefit from experiencing the forest environment beginning as early as the Dipsea Trail footbridge rather than past the Entry Plaza as a result of the improved wayfinding. Placing ABA-compliant parking farther from the monument entrance would result in a slightly longer distance to travel for those visitors, but the number ABA-compliant parking spaces would increase by two and would still be the closest parking spaces to the entrance of the monument. The overall arrival and amenity improvements, paired with the reduced vehicle and pedestrian congestion from the implementation of the reservation system, would provide a safer and more enjoyable experience for all visitors.

There would be limited, short-term, adverse cumulative impacts on visitor experience and safety during the construction period of the cumulative projects and long-term, beneficial impacts from reduced congestion in parking lots, along Muir Woods Road, and on the trail system to Muir Beach. Impacts associated with the cumulative projects would be beneficial, and impacts from alternative 2 would be both beneficial and adverse. The overall contribution of impacts from alternative 2 to the cumulative impacts would be beneficial because of the improved arrival, entry, and departure experience; visitor amenities; wayfinding; interpretive media; and emergency access and circulation.

### **Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements**

**Analysis.** The visitor arrival, entry, and departure experience would be similar to those described for alternative 2, resulting in beneficial impacts. Under alternative 3, a new parking lot would be constructed next to the proposed woodland pedestrian trail connecting the Annex Lot and the former Nursery Area. The trail would allow visitors to begin to experience the forest upon departure from the former Nursery Area. The woodland pedestrian trail would go around the Annex Lot but would avoid crossing the driveway serving the Annex Lot, providing a more enjoyable pedestrian experience because it would position visitors away from the road and provide a safe path to the monument. Visitors would still need to cross Muir Woods Road from the Conlon Lot; however, wayfinding would clearly direct visitors to the woodland pedestrian trail. Impacts on the arrival, entry, and departure experience would be direct, long term, and beneficial.

Visitor amenities, wayfinding, and interpretive and educational opportunities would be improved as described for alternative 2. Interpretive media would be added to the new woodland trail connecting the Nursery and Annex Lots to provide visitors with information on the monument's history. These changes in the visitor amenities, wayfinding, and interpretive and educational opportunities would provide a direct, long-term, beneficial impact on the visitor experience.

ABA-compliant parking and removal of two spaces for privately owned vehicles in the Entry Plaza would be the same as described for alternative 2. The removal of all shoulder parking under this alternative would benefit emergency access vehicles by providing a wide and clear right of way for navigation along Muir Woods Road. Therefore, impacts on visitor safety would be beneficial as a result of the improved emergency access vehicles. The circulation for the Main, Annex, and Conlon Lots would be the same as described for alternative 2. The addition of the Nursery Lot would improve vehicular circulation patterns and provide an unobstructed path back to Muir Woods Road, also known as a travel-way aisle. With the incorporation of wider travel-ways and counter-clockwise loop designs for the parking lots, impacts on visitor safety would be direct, long term, and beneficial from improved circulation patterns and emergency vehicle access.

Construction of alternative 3 would result in impacts similar to those under alternative 2. Alternative 3 would, however, include construction of a Nursery Lot, a new lift station, adjoining restrooms, and power and force main lines. Visitors would experience traffic congestion on Muir Woods Road and

in the Conlon Lot during installation of the line. Therefore, this alternative would result in direct, short-term, adverse impacts on the visitor arrival, entry, and departure experience.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 3 would result in direct, short-term, adverse impacts and direct, long-term, beneficial impacts on visitor experience. When the impacts of alternative 3 are combined with the effects of cumulative actions in the project area, an overall long-term, beneficial cumulative impact on visitor experience and safety is expected.

**Conclusion.** Under alternative 3, the Nursery Lot, a new lift station, adjoining restrooms, and power and force main lines would be constructed and all shoulder parking between the Conlon Lot and the Muir Woods Road Bridge would be removed. Alternative 3 would also include all the elements as alternative 2, including removing vehicles from the Entry Plaza, reducing the Annex Lot driveways from two to one, adding new wayfinding signs, adding new interpretive media at the Entry Plaza and along the Redwood Creek trail, increasing the number of ABA-compliant parking spaces, adding a new restroom facility, relocating the existing restroom facility, and removing privately owned vehicle parking spaces from the Main Lot. Together, these improvements would have beneficial impacts on all aspects of visitor experience and safety by providing wayfinding to guide visitors, placing interpretive media in multiple locations, providing multiple restrooms, ensuring better emergency access, and prohibiting shoulder parking. Impacts from the relocation of ABA-compliant parking spaces to the Main Lot would be long term and adverse.

Limited, short-term, adverse cumulative impacts would occur on visitor experience and safety during the construction period of the cumulative projects, and long-term, beneficial impacts would result from reduced congestion in parking lots, along Muir Woods Road, and on the trail system to Muir Beach. The impacts from cumulative projects combined with impacts from alternative 3 would be beneficial. The contribution of alternative 3 to the cumulative impacts would be beneficial because the arrival, entry, and departure experience; visitor amenities; wayfinding; interpretive media; and emergency access would be improved.

## TRANSPORTATION

### Methodology and Assumptions

The analysis of transportation is based on the location of the parking lots, access between the lots, circulation of vehicles through the lots, and visitor safety during the walk between a parking area or the bus and shuttle drop-off area to the Entry Plaza.

For the purposes of this analysis, it is assumed that limiting parking to 232 spaces for privately owned vehicles, implementing the reservation system, and continuing to operate the Muir Woods Shuttle will reduce daily visitation to levels that meet the goals and performance standards in the *Record of Decision for the Golden Gate National Recreation Area and Muir Woods National Monument Final General Management Plan / Environmental Impact Statement* (NPS 2015e).

### Impacts of Alternative 1: No Action

**Analysis.** The driveway serving the Conlon Lot would continue to operate with the sight distance issues described in chapter 3, which could affect the safety of vehicles entering and exiting the lot from Muir Woods Road. The density of trees and curve of the road obstruct a driver's view from the Conlon Lot driveway and leave a short distance to react to a vehicle entering or exiting the parking

lot. Shoulder parking would still be permitted between the Conlon Lot and the Muir Woods Road Bridge and could result in vehicles making U-turns to access spaces if they arrive on the opposite side of the designated roadside parking area. Therefore, impacts on vehicle safety would be direct, long term, and adverse.

Vehicle-pedestrian conflicts would continue to occur because the existing trail system between the Entry Plaza and parking lots crosses the parking lot driveways and requires visitors to cross Muir Woods Road. The Annex Lot would continue to have two driveways crossing the trail system. The pedestrian crossing between the Conlon Lot and the existing trail system would continue to pose a safety risk because the limited sight distance for vehicles traveling toward the Entry Plaza does not provide enough reaction time to stop for a pedestrian in the crosswalk. Shoulder parking between the Conlon Lot and Muir Woods Road Bridge would continue to require pedestrians to cross Muir Woods Road at random locations to access the trail on the opposite side of the road. Pedestrians would also continue to access vehicles parking on the shoulder south of Muir Woods Road Bridge along Muir Woods Road, where no off-road trail exists and visitors walk unprotected in the roadway; however, this would be remedied by 2021 when all shoulder parking is eliminated south of Muir Woods Road Bridge, as discussed under cumulative impacts. Therefore, impacts on pedestrian safety would be direct, long term, and adverse as a result of the driveway crossings, the Conlon Lot pedestrian crossing, and shoulder parking north of the Muir Woods Road Bridge.

The number of privately owned vehicles entering the Main Lot would not change, which would continue to cause conflicts between the buses and privately owned vehicles searching for parking spaces or backing out of parking spaces. Therefore, impacts would be direct, long term, and adverse.

**Cumulative Impacts.** Phase 1 of the reservation system removed some shoulder parking from Muir Woods Road, thus limiting the number of visitors who can arrive by privately owned vehicle. The reservation system will also limit the number of vehicles parking at the monument and reduce the number of vehicles entering and exiting the monument at one time. As a result, fewer vehicles will be driving to the monument and fewer drivers will be searching for parking, especially during peak times, resulting in reduced traffic congestion and improved safety along Muir Woods Road where shoulder parking is removed. The reduction of available privately owned vehicle parking is also anticipated to result in increased bus and shuttle use as the modal split shifts to alternative transportation modes. Therefore, implementation of the reservation system will have long-term, beneficial impacts on transportation.

The Muir Woods Road Bridge Replacement Project would replace an existing structure and improve the roadway alignment by removing an “S” curve or reverse curve where drivers must transition from a right roadway curve directly into a left roadway curve without the road straightening out to provide a safe transition between the curves. This geometric improvement would improve vehicle safety; therefore, the project would result in short-term, adverse impacts on transportation during the construction period and long-term, beneficial impacts on transportation once it is complete.

The Muir Woods Road Rehabilitation Project would resurface portions of Muir Woods Road and address the poor condition of the road where the pavement contains cracks, the shoulder has disappeared, and lane striping has faded or disappeared. Newly resurfaced pavement would improve vehicle safety; therefore, the project would result in short-term, adverse impacts on transportation during the construction period and long-term, beneficial impacts on transportation once the project is complete.

The Muir Woods Water and Wastewater Service Rehabilitation Project would install new water and sewer lines to connect the former Nursey Area to the visitor center. The lines would travel through

the Annex Lot, Main Lot, and Entry Plaza. This connection would run parallel to but not within the roadbed of Muir Woods Road. The project would be coordinated with Marin County and the Muir Woods Road Rehabilitation Project to minimize adverse impacts. During construction, impacts on transportation would be short term and adverse, potentially causing traffic congestion and safety issues from temporary parking lot closures and reduced traffic flow on Muir Woods Road.

During construction of the Redwood Creek Trail Realignment and Dias Ridge Trail Extension Project, impacts on the network of walking trails would be short term and adverse because of temporary trail closures that would require visitors to use alternative routes. The trail project would, however, improve connectivity between the monument and Muir Beach by providing a new route with less potential for flooding; therefore, the project would result in long-term, beneficial impacts.

The Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project would involve replacing existing pedestrian bridges that are in poor condition, providing visitors with an opportunity to use safer bridges; therefore, the project would result in direct, long-term, beneficial impacts on transportation. During the construction phase, this project would result in direct, short-term, adverse impacts on transportation because the trail could be closed, requiring visitors to follow an alternative route.

Cumulative projects would result in short-term, adverse impacts and long-term, beneficial impacts. When the adverse impacts of alternative 1 are combined with the beneficial effects of cumulative actions to transportation, an overall long-term, adverse cumulative impact on transportation is expected from the remaining pedestrian and parking safety issues.

**Conclusion.** Under alternative 1, pedestrian and parking safety issues would remain because parking lot circulation, shoulder parking between Muir Woods Road Bridge and Conlon Lot, shoulder parking south of Muir Woods Road Bridge, and parking lot driveway access to Muir Woods Road would remain unchanged, resulting in long-term, adverse impacts.

Cumulative impacts on transportation would be limited, short term, and adverse during the construction period for the cumulative projects and long term and beneficial from resurfacing the pavement, replacing an old bridge, improving trail connectivity, prohibiting shoulder parking, and implementing the reservation system. The impacts of the cumulative actions would be beneficial; however, alternative 1 would contribute adverse impacts and would not address vehicle and pedestrian safety concerns. The contribution of alternative 1 to the cumulative impacts would be substantial because the vehicle and pedestrian safety in the parking lots would not be improved, resulting in an overall adverse cumulative impact.

## **Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements**

**Analysis.** Under alternative 2, the number of driveways in the Annex Lot would be reduced from two to one bi-directional driveway, and the Dipsea Trail would be rerouted to the northwest perimeter of the lot, thereby reducing the number of places for potential vehicle-pedestrian conflicts. These changes would also improve the internal lot circulation by creating a loop pattern and reducing the potential for vehicle to vehicle conflicts. The Main Lot would only serve shuttles, tour buses, and privately owned vehicles with handicap placards, reducing bus conflicts with most privately owned vehicles. Widening the Conlon Lot would provide more maneuvering space for vehicles to travel through the lot and access parking spaces, and the new woodland pedestrian trail would provide a safe path for pedestrians to enter and exit the monument without walking along the main vehicular travel-way. Potential impacts from pedestrians crossing Muir Woods Road would be

mitigated through appropriate signage posted to alert drivers of the Conlon Lot pedestrian crossing, and pedestrian signs posted on both sides of the pedestrian crossing would improve vehicle and pedestrian safety when accessing the Conlon Lot. Vehicles traveling along Muir Woods Road would be warned of the upcoming intersection serving the Conlon Lot and directed to slow down to yield to potential vehicle and pedestrian movements. Mitigation measures would also include pruning branches along the southbound side of Muir Woods Road south of the Conlon Lot to improve the sight distance for left-turning vehicle movements into and out of the Conlon Lot driveway. Therefore, impacts on transportation from vehicle safety would be direct, long term, and beneficial, as a result of reduced vehicle conflict areas and improved signage and sight distances.

Several pedestrian and vehicle safety issues would continue to exist under alternative 2. Shoulder parking issues between the Conlon Lot and Muir Woods Road Bridge would remain the same as described for alternative 1. Shoulder parking in this location would continue to require visitors to cross Muir Woods Road at random locations to access the trail system serving the monument and would also require vehicles to potentially make U-turns to access the designated roadside parking area. Therefore, impacts on transportation from vehicle safety would be direct, long term, and adverse as a result of continued shoulder parking.

A reconfigured Main Lot would provide more space for buses to maneuver and more bus parking spaces to allow buses to park while waiting for their passengers to return from visiting the monument. Vehicle to vehicle conflicts would be reduced because all privately owned vehicle parking would be relocated to the Annex Lot. Activity from privately owned vehicles in the Main Lot would be minimal based on the proposed mitigation to restrict privately owned vehicle drops-offs in the Main Lot to only vehicles with disabled visitors. Therefore, impacts on shuttle/bus safety and circulation would be direct, short and long term, and beneficial.

Alternative 2 would also result in direct, short-term, adverse impacts on transportation during construction from the displacement of existing parking when the parking lots are reconfigured.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 2 would result in short-term, adverse and long-term, beneficial impacts on transportation. Implementation of mitigation and safety measures in potentially problematic locations as noted in chapter 2 would further minimize most of the impacts and provide overall long-term benefits. When the impacts of alternative 2 are combined with the effects of cumulative actions, an overall long-term, beneficial cumulative impact on transportation is expected.

**Conclusion.** Under alternative 2, many of the safety issues would be addressed through reducing the number of driveways crossing pedestrian trails and posting signs to warn drivers of approaching pedestrian crossings. Shoulder parking north of the Muir Woods Road Bridge would remain in place and continue to create unsafe vehicle conditions from potential U-turns to access the parking spaces and unsafe pedestrian conditions for visitors to walk between their vehicles to the opposite side of the roadway to access the trail to the monument.

Cumulative impacts on transportation would be limited, short term, and adverse during the construction period of the cumulative projects. However, greater long-term, beneficial impacts would result from resurfacing the pavement, replacing an old bridge, improving trail connectivity, prohibiting shoulder parking, and implementing the reservation system. The impacts of the cumulative actions would be beneficial and, combined with the impacts from alternative 2, would continue to be beneficial, especially addressing vehicle and pedestrian safety in the parking lots. A few safety issues would remain, specifically with regard to shoulder parking; however, the



contribution of alternative 2 to the cumulative impacts would result in an overall beneficial cumulative impact.

### **Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements**

**Analysis.** In addition to the improvements under alternative 2, alternative 3 would eliminate shoulder parking and construct a Nursery Lot to accommodate vehicle parking needs. The new pedestrian trail would connect the Conlon and Nursery Lots to the Entry Plaza and would be located along the creek side of the Annex Lot, avoiding the driveway crossings. Therefore, impacts on vehicle safety would be direct, long term, and beneficial as a result of reduced vehicle conflict areas and improved signage and sight distance from trimming low hanging branches. Impacts on pedestrian safety would be direct, long term, and beneficial, reflecting reduced parking lot trail crossings and removal of shoulder parking.

Shuttle and tour buses would operate in the same manner as under alternative 2, resulting in direct, long-term, and beneficial impacts on shuttle/bus safety and circulation.

Similar to alternative 2, alternative 3 would result in direct, short-term, adverse impacts on transportation as a result of construction and the displacement of existing parking when the parking lots are reconfigured. Alternative 3 would also include the construction of power and force main lines. Visitors in vehicles would experience traffic congestion on Muir Woods Road and in the Conlon Lot while the line is installed. Therefore, this alternative would result in direct, short-term, adverse impacts on transportation.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 3 would result in short-term, adverse and long-term, beneficial impacts on transportation. When the impacts of alternative 3 are combined with the effects of cumulative actions, an overall long-term, beneficial cumulative impact on transportation is expected.

**Conclusion.** Alternative 3 would result in the benefits described under alternative 2, including improved safety issues from removing most of the driveways crossing pedestrian trails and posting signs to warn drivers of approaching pedestrian crossings. Alternative 3 would contribute additional beneficial impacts by eliminating shoulder parking between the Conlon Lot and Muir Woods Road Bridge and relocating parking to the Nursery Lot, thereby improving vehicle and pedestrian safety. The development of the woodland pedestrian trail would further improve pedestrian safety and contribute beneficial impacts on transportation.

Cumulative impacts on transportation would be limited, short term, and adverse during the construction period; however, greater, long-term, beneficial impacts would result from resurfacing the pavement, replacing an old bridge, improving trail connectivity, prohibiting shoulder parking, and implementing the reservation system. The impacts of the cumulative actions would be beneficial and, combined with the impacts from alternative 3, would continue to be beneficial, addressing many of the vehicle and pedestrian safety issues in the parking lots and on Muir Woods Road. The contribution of alternative 3 to the cumulative impacts would result in an overall beneficial cumulative impact.

## GEOLOGY AND SOILS

### Methodology and Assumptions

Impacts on soils are considered in this analysis through four measures: soil removal, soil compaction, soil erosion, and disturbance relative to the project area. Activities that may result in impacts on soils include ongoing shoulder parking; parking lot, trail, bridge, and restroom construction; and rehabilitation or revegetation. Development of engineered stormwater management infrastructure and placement of wayfinding signs or interpretive media would also affect soils. These impacts were assessed by examining soil information and mapping for the monument (see chapter 3).

### Impacts of Alternative 1: No Action

**Analysis.** Under the no-action alternative, vehicular and pedestrian traffic would continue to directly compact soils in areas where barriers do not yet exist along Muir Woods Road and on existing trails. Compaction reduces the amount of space occupied by air within soil aggregates that allows water to drain freely. As a result, soil compaction would remain high, adversely affecting the rate of infiltration of rainwater, leading to surface runoff, sheet erosion, and gully formation. Since soil aeration depends largely on the presence of large pores, compaction would continue to cause ethylene production. High concentrations of ethylene, a natural gas produced by soil microbes in the absence of oxygen, would indirectly damage the roots of plants and impede their ability to exchange vital gases. Existing damaged or inadequately sized culverts would continue to contribute to a high volume of surface runoff and sedimentation into Redwood Creek during rain events, leading to increased soil erosion. Overall, impacts on soils would continue to be directly and adversely affected over the long term.

**Cumulative Impacts.** Implementation of the reservation system will limit the number of vehicles parking at the monument, which will reduce ground disturbance and the potential for soil erosion as fewer vehicles park along the road. Furthermore, erosion and sediment control measures established in phase 1 of the project should aid in soil recovery in the project area. Over time, vegetation should grow where barriers have been established and improve the water-holding capacity of the soil. When soils are stabilized with vegetation, they are less likely to erode and more likely to allow infiltration of rainfall, thereby reducing sediment loads and runoff into Redwood Creek. Therefore, this project will result in indirect, long-term, beneficial impacts on soil resources.

The Muir Woods Road Bridge Replacement Project would affect the soils along Muir Woods Road and on the banks of Redwood Creek. The replacement of the bridge and the realignment of Muir Woods Road would disturb soils and increase the potential for soil erosion over the long term. Although the project would adhere to applicable erosion and sediment control regulations and implement best management practices (i.e., sediment barriers) to control runoff, the project would result in indirect and direct, short-term, adverse impacts on soil resources.

Portions of Muir Woods Road would be resurfaced and a number of culverts would be repaired or replaced as part of the Muir Woods Road Rehabilitation Project. These actions would permanently disturb soils and temporarily affect the flow of the associated drainages, increasing the potential for sediment to enter Redwood Creek. Implementation of best management practices and erosion and sediment control measures would capture sediment runoff during construction and minimize sediment transport. After construction is complete, the culverts would help to decrease the amount of runoff and gully formation, resulting in indirect, long-term, beneficial impacts on soils.

The Muir Woods Water and Wastewater Service Rehabilitation Project would involve replacing existing water supply infrastructure and relocating and/or rehabilitating existing wastewater infrastructure away from Redwood Creek and outside the erosion hazard area. Infrastructure installation would require trenching or pipe bursting technology. Trenching and excavation would disturb, expose, and remove soils, resulting in short-term, adverse impacts on soils from increased potential for soil erosion and sedimentation. The use of the trenchless pipe bursting technology in sensitive areas would minimize adverse impacts. During installation, approximately 3 to 6 inches of top soil would be set aside, screened, and used to restore the disturbed areas after construction. The project would adhere to applicable erosion and sediment control regulations and implement best management practices to minimize temporary adverse impacts during construction. Disturbed areas would be restored by replacing excavated soils and revegetating with local species, thereby preventing long-term, adverse impacts.

The Redwood Creek Trail Realignment and Dias Ridge Trail Extension Project would involve the realignment and extension of existing trails and the removal of culverts, fords, and abandoned bridges along trails within the Redwood Creek Watershed. Construction activities would compact, expose, and disturb soils, increasing the potential for soil erosion and sedimentation resulting in direct, short-term, adverse impacts on soils. Implementation of best management practices and erosion and sediment control measures would capture sediment runoff during construction and minimize sediment transport. Over the long term, the trail realignments and improvements would reduce sediment erosion and result in indirect beneficial impacts on soils.

The Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project would entail removing riprap from the banks of Redwood Creek, which would require excavating large boulders and placing large woody debris in the creek. These construction activities would result in short-term, adverse impacts from the removal of soil in the erosion hazard area of the monument, soil compaction from workers and construction equipment, and increased potential for soil erosion and turbidity and sedimentation in the creek. Potential temporary adverse impacts would be avoided and/or minimized through adherence to permit requirements, the use of best management practices, and revegetation. The removal of riprap and placement of large woody debris would result in some beneficial impacts by reducing erosion in localized areas but overall long-term, adverse impacts from increased channel alteration, bank erosion, and soil loss on the upper streambanks would occur. Bridge replacement and trail repair would result in long-term, beneficial impacts from a reduction in soil and bank erosion. Therefore, impacts on soils would be both long term, adverse and beneficial.

Cumulative adverse impacts from these projects would include soil removal, soil erosion, and continued sedimentation into Redwood Creek. Some projects would result in beneficial impacts once they are completed, such as reduced erosion, reduced runoff and sedimentation, and increased localized creek bank stability.

**Conclusion.** Under alternative 1, impacts on soils would be direct and adverse from continued vehicular and pedestrian traffic, as well as surface runoff and sedimentation from existing damaged or undersized culverts. Indirect adverse impacts on the health of vegetation from soil compaction would also occur. Alternative 1 would contribute a substantial, adverse increment to cumulative impacts that are otherwise expected to be largely beneficial, resulting in an overall adverse cumulative impact.

## **Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements**

**Analysis.** Under alternative 2, construction activities related to the Annex Lot expansion would be in an area where lithified rock is buried by unconsolidated sediments; therefore, construction activities would not disturb geologic formations. However, approximately 0.2 acre of topsoil and subsoil would be adversely affected by cutting, filling, grading, and paving activities and from the installation of two culverts. Because the primary soil complex in the Annex Lot is Blucher-Cole, a poorly suited soil for development, the soil would likely require modification with a suitable soil type. Soil mixing from the use of fill materials would disrupt the soil structure, adversely affecting native soils and plants over the long term within and adjacent to the Annex Lot.

Where the topography is relatively flat and grading occurs, impacts would be limited to the upper subsurface soil horizons. Once asphalt has been laid to surface the Annex Lot, a minimal increase in runoff is expected from the increase in impervious surfaces. Similar impacts are anticipated from the expansion of the Conlon Lot and the paving of the designated roadside parking area because these areas consist of Dipsea-Barnabe very gravelly loam, another soil poorly suited for development. Constructing new restrooms in the Entry Plaza and near the former Nursery Area would also permanently disturb soils within their respective footprints, resulting in direct, long-term, adverse impacts. Minimization and mitigation measures, such as those described in chapter 2, would be used to prevent further disturbance to soils in the project area.

Staging and stockpiling construction equipment and fill material would result in direct, short-term, adverse impacts on soils. Because ground pressure would increase, the adverse effects would likely include an increased soil resistance to penetration and reduced conductivity of soil to water and gas flow through a reduction in the size of pores. Indirect, adverse effects from these actions would include an increase in exposed mineral soil, displaced soil particles, and slower rainfall infiltration.

The installation of interpretive media and wayfinding signs along trails and traffic signage along Muir Woods Road would minimally affect soils in the long term because soils in these areas would be removed to install posts. During realignment of the Dipsea Trail and construction of a footbridge over Redwood Creek, soil disturbance, including potential creek bank disturbance, would increase the potential for soil erosion. Construction of infiltration trenches near each parking lot is also anticipated to temporarily affect soils from direct removal within the footprint of the trench. These actions would result in direct, short and long-term, adverse impacts on soils. However, long-term, beneficial impacts on soils are expected because visitors would no longer walk through the creek, thereby reducing turbidity and sedimentation.

Approximately 0.4 acre of the Entry Plaza and 0.2 acre of the former Nursery Area would be revegetated with plants native to the monument. This action would keep the soil and seed bank stabilized in the erosion hazard area and reduce the movement of silt, resulting in direct, long-term, beneficial impacts.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 2 would result in short and long-term, adverse impacts in localized areas affected by management actions; however, these impacts would be minimized through mitigation. Beneficial impacts on soils would occur from rehabilitation and revegetation activities. When the impacts of alternative 2 are combined with the effects of cumulative actions in the project area, an overall long-term, beneficial cumulative impact on soils is expected.

**Conclusion.** Under alternative 2, impacts on soils would be direct, short and long term, and adverse from removal, compaction, soil structure modification, and increased runoff. Direct, long-term, beneficial impacts from the alternative include decreased turbidity and sedimentation in Redwood Creek, riparian rehabilitation in the Entry Plaza, and revegetation of portions of the former Nursery Area. The contribution of alternative 2 to the cumulative impacts would result in an overall adverse impact in the short term, but beneficial impacts in the long term.

### **Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements**

**Analysis.** Under alternative 3, construction activities related to the establishment of a new Nursery Lot would be in an area where lithified rock is buried by unconsolidated sediments; therefore, construction activities would not disturb geologic formations. Approximately 0.4 acre of topsoil could be adversely affected by cutting, filling, grading, and paving activities and from the installation of a single culvert. In addition to development of a parking lot, construction activities in the Nursery Lot would include the installation of a lift station, adjoining restrooms, and underground power and force main lines. These activities would require ground disturbance and excavation. Removal and compaction would expose and disturb soils, leading to increased potential for soil erosion and sedimentation resulting in direct, short-term, adverse impacts on soils. Following installation of the lift station and associated utilities, monument staff would likely revegetate the disturbed areas preventing long-term impacts from soil erosion. Because the primary soil complex in the former Nursery Area is Blucher-Cole, a poorly suited soil for development, the soil would likely require modification with a suitable soil type. Soil mixing from the use of fill material would disrupt the soil structure, adversely affecting native soils and plants over the long term within and adjacent to the Nursery Lot.

Once asphalt has been laid to surface the Nursery Lot, a minimal increase in runoff is expected. Similar impacts are expected from the expansion of the Conlon Lot because this area consists of Dipsea-Barnabe very gravelly loam, another soil poorly suited for development. Constructing new restrooms in the Entry Plaza would also permanently disturb soils within their respective footprints, resulting in direct, long-term, adverse impacts. Minimization and mitigation measures, such as those described in chapter 2, would be used to prevent further disturbance to soils in the project area.

Approximately 1,200 linear feet of vegetation would be removed to construct a new woodland pedestrian trail between the Annex and Nursery Lots, resulting in long-term, adverse impacts on soils from increased compaction and runoff potential. The new trail would affect the Blucher-Cole soil complex through cutting, filling, and grading activities. However, approximately 1,500 feet of the existing pedestrian trail along Muir Woods Road between the Main and Nursery Lots would be decommissioned and revegetated with plants native to the monument, resulting in long-term, beneficial impacts on soils as a result of soil stabilization, increased permeability, nutrient cycling, and reduced runoff.

Similar to alternative 2, staging and stockpiling of construction equipment and fill material would result in direct, short-term, adverse impacts on soils; the installation of interpretive media and wayfinding signs along trails and traffic signage along Muir Woods Road would directly and adversely affect soils in the long term; the Dipsea Trail realignment and construction of a footbridge over Redwood Creek would adversely and beneficially affect soils over the short and long term; and the construction of infiltration trenches near each parking lot would temporarily affect soils from direct removal.

Similar to alternative 2, approximately 0.4 acre of the Entry Plaza and 0.2 acre of the former roadside parking area would be revegetated with plants native to the monument. This action would keep the

soil and seed bank stabilized in the erosion hazard area and reduce the movement of silt, resulting in indirect, long-term, beneficial impacts. Additionally, approximately 0.2 acre of the former roadside parking area designated in alternatives 1 and 2 would be revegetated with plants native to the monument, resulting in beneficial impacts on soils from stabilization, increased permeability, nutrient cycling, and reduced runoff.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 3 would result in limited, short and long-term, adverse impacts in localized areas affected by management actions; these impacts would be minimized through mitigation. Beneficial impacts on soils would occur from rehabilitation and revegetation activities. When the impacts of alternative 3 are combined with the beneficial effects of cumulative actions in the project area, the overall cumulative impact on soils is expected to be long term and beneficial.

**Conclusion.** Under alternative 3, impacts on soils would be direct and adverse as a result of removal, compaction, soil structure modification, and increased runoff over the short term and long term. Direct, long-term, beneficial impacts from the alternative include decreased turbidity and sedimentation in Redwood Creek, riparian rehabilitation in the Entry Plaza, and revegetation of roadside parking areas. The contribution of alternative 3 to the cumulative impacts would result in an overall adverse impact in the short term, but some beneficial impacts over the long term.

## VEGETATION

### Methodology and Assumptions

Impacts on vegetation considered in this analysis include permanently removed or degraded plants as a result of construction activities, the potential for invasive, nonnative plant dispersal and associated control, and rehabilitation or revegetation of disturbed areas. In addition, impacts on rare plant species are addressed in this section. Information gathered on park vegetation types and distribution is described in chapter 3, including the type of vegetative cover found near parking areas and along Muir Woods Road that could be disturbed under any of the alternatives.

### Impacts of Alternative 1: No Action

**Analysis.** Under alternative 1, vehicular and pedestrian trampling would continue to directly and adversely affect vegetation in areas where barriers do not yet exist along Muir Woods Road, along existing trails, and in riparian areas, resulting in breakage, loss of productivity, and mortality of plants in the long term. Additionally, plant cover and biomass would remain low because soil compaction could inhibit seed germination. Soil compaction would also cause indirect effects on vegetation because individual plants would grow fewer lateral roots and root hairs, effectively reducing their ability to use available nutrients. However, no adverse impacts on rare plants such as California bottlebrush grass or leopard lily are anticipated because existing infrastructure does not currently affect these species. Therefore, this alternative would result in long-term, adverse impacts on vegetation, mainly in areas that have already been disturbed.

**Cumulative Impacts.** Phase 1 of the reservation system temporarily disturbed sparse vegetation when barrier posts were installed. However, the barrier posts prevent parking along the shoulder of Muir Woods Road and therefore eliminate vehicular ground disturbance, allowing vegetation to reestablish in these areas. Furthermore, the project implemented erosion and sediment control measures that should aid in vegetative growth. Over time, vegetation will increase organic matter

content and improve the water-holding capacity of the soil and aid subsequent plant growth, resulting in indirect, long-term, beneficial impacts on vegetation.

The Muir Woods Road Bridge Replacement Project would adversely affect vegetation in the short term along Muir Woods Road and on the banks of Redwood Creek. Depending on the amount of vegetation affected, the project could temporarily alter creek flow as a result of trampling, breakage, and removal of riparian plant species, resulting in direct, short-term, adverse impacts on vegetation from degradation of plants near the bridge.

The Muir Woods Road Rehabilitation Project would involve resurfacing portions of Muir Woods Road and repairing or replacing culverts in the project area. Excavation and trampling by workers has a high potential to remove or damage vegetation; however, impacts would be minimized through the implementation of best management practices. After construction is complete, vegetation would reestablish or be replanted, resulting in direct, long-term, beneficial impacts on this resource.

Construction associated with the Muir Woods Water and Wastewater Rehabilitation Project would require ground disturbance and excavation. In areas where there are sensitive plants such as coast redwood, California bottlebrush, leopard lily, or California buckeye, trenching would be avoided by installing pipe bursting technology. Flexible high-density polyethylene piping would be used to avoid the drip lines of sensitive trees, and root cutting would not be permitted. Areas cleared for trench construction would be revegetated. Though construction would remove vegetation and lead to increased potential for soil erosion and sedimentation in the short term, best management practices would minimize adverse impacts to vegetation.

The Redwood Creek Trail Realignment and Dias Ridge Trail Extension Project would require the removal of vegetation with hand tools and chainsaws. Trail construction would clear herbaceous plants and require grading. Though the project would avoid large trees to the extent possible, smaller trees would need to be removed to realign or extend the trails. Multiple downed trees would be removed from the trails, and woody debris would be left on site. Any limbs that need to be trimmed from live large trees would be pruned at the limb collar to promote healing. Some trees along the new trails, such as the Monterey cypress (*Cupressus macrocarpa*), are in poor condition and would be removed for visitor safety. Where possible, Monterey cypress would be replanted, and abandoned trail segments would be revegetated. These activities would result in direct, long-term, adverse impacts on vegetation along new trails. However, direct, long-term, beneficial impacts are anticipated where trees are replanted and abandoned trails are revegetated.

The Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project would entail removing riprap from the banks of Redwood Creek, which would require excavating large boulders and placing large woody debris in the creek. These activities would result in short-term, adverse impacts from the removal of vegetation in the erosion hazard area of the monument. However, direct, beneficial impacts on vegetation would occur in the long term because native vegetation would be planted to stabilize creek banks.

Cumulative adverse impacts from these projects would remove and degrade vegetation. Some projects, such as those that include revegetation, increased organic matter, increased water-holding capacity of soil, and stabilization of the Redwood Creek bank, would result in beneficial impacts in the long term once they are completed.

**Conclusion.** Under alternative 1, impacts on vegetation would continue to be adverse from ongoing ground disturbance in the long term. Plant cover and biomass would remain low in a variety of areas because soil compaction could inhibit seed germination and restrict the root growth of plants. No



adverse impacts on rare plants are anticipated because existing infrastructure does not currently affect these species. The contribution of alternative 1 to cumulative impacts would result in an overall adverse impact in the short term, but some beneficial impacts over the long term.

### **Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements**

**Analysis.** Under alternative 2, vegetation would be permanently removed from approximately 0.2 acre of land southeast of the Annex Lot to expand the lot, resulting in direct, long-term, adverse impacts. Trees and shrubs such as arroyo willow and coast live oak would be cleared and grubbed, which would result in direct mortality and a slight decrease in nutrient cycling. Native understory shrubs, ferns, forbs, and grasses would also be removed.

Low-hanging branches along Muir Woods Road would be pruned and the Conlon Lot entrance would be realigned to improve the sight distance for vehicles attempting to enter and exit the lot or pull-in and out of roadside parking. Species adversely affected by direct mortality in the Conlon Lot from expansion and laying down pavement in the roadside parking area would largely include bay laurel and sword fern. California buckeye could also be adversely affected; however, buckeye trees greater than 20 inches in diameter at breast height would not be removed unless approved by monument staff.

Adverse impacts are not anticipated on California bottlebrush grass or leopard lily because a rare plant survey would be conducted prior to any construction activities. However, if state or locally listed plants are found and cannot be avoided, these plants would be transplanted or seeds would be collected, propagated, and replanted in another location.

Staging and stockpiling of construction equipment and fill material would result in trampling, potential vegetation loss, and the increased potential for the spread of invasive, nonnative plants (e.g., forget-me-not, panic veldtgrass, cape ivy, brooms, acacia) and diseases (e.g., sudden oak death). The spread of these invasive, nonnative plants and diseases would mostly occur from equipment that harbor seed in tire treads or from transporting host plant material. However, equipment would be washed and inspected to remove seed and host plant material to mitigate these potential impacts.

Installation of interpretive media and wayfinding signs along trails and traffic signage along Muir Woods Road would directly and adversely affect vegetation in the long term because vegetation in these areas would be uprooted or maintained at a specific height to enhance visitor experience and improve safety. During realignment of the Dipsea Trail and construction of a footbridge over Redwood Creek, ground disturbance, including potential creek bank disturbance, would increase the potential for loss of riparian vegetation. In addition, the construction of infiltration trenches near the parking lots is anticipated to affect vegetation by directly removing various plant species within the footprint of the trench. These actions would result in direct, long-term, adverse impacts on vegetation.

Approximately 0.4 acre of the Entry Plaza and 0.2 acre of the former Nursery Area would be revegetated with plants native to the monument. This action would keep the soil and seed bank stabilized in the erosion hazard area, reduce the movement of silt, keep the water temperature of Redwood Creek cooler, and increase the availability of food and nesting habitat for a variety of wildlife species. Furthermore, an increase in vegetation would result in a reduction in nutrient and chemical pollution by trapping and filtering these substances before they enter Redwood Creek. However, constructing new restrooms in the Entry Plaza and near the former Nursery Area would likely remove vegetation within their footprints, resulting in direct, long-term, adverse impacts.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 2 would result in short and long-term, adverse impacts in localized areas affected by management actions; however, these impacts would be minimized through mitigation. Overall long-term benefits would result from rehabilitation and revegetation of disturbed areas. Therefore, when the primarily beneficial impacts as a result of alternative 2 are combined with the beneficial effects of other cumulative actions in the project area, an overall long-term, beneficial cumulative impact on vegetation is expected.

**Conclusion.** Under alternative 2, direct, adverse impacts would occur from removing vegetation from the Annex and Conlon Lots, the roadside parking area, and from the riparian area of Redwood Creek. Direct mortality of plants would also occur in the footprints of the new restrooms and infiltration trenches. However, beneficial impacts from riparian rehabilitation in the Entry Plaza and revegetation of portions of the former Nursery Area would result in long-term, beneficial impacts. No impacts on rare plants are anticipated because a survey would be conducted prior to any construction activities. Alternative 2 would primarily contribute a beneficial increment to cumulative impacts, resulting in an overall beneficial cumulative impact on vegetation.

### Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements

**Analysis.** Under alternative 3, vegetation would be permanently removed from less than 0.4 acre of land in the former Nursery Area when the Nursery Lot, lift station, and adjoining restrooms are constructed, which would result in direct, long-term, adverse impacts. Trees and shrubs such as arroyo willow and coyote bush (*Baccharis pilularis*) would be cleared and grubbed, which would result in direct mortality and a slight decrease in nutrient cycling. Native understory shrubs, ferns, forbs, and grasses would also be removed. California buckeye could be adversely affected because up to three trees could be removed to construct the Nursery Lot. However, buckeye trees over 20-inches in diameter at breast height would not be removed unless approved by monument staff.

Low-hanging branches along Muir Woods Road would be pruned and the Conlon Lot entrance realigned to improve the sight distance for vehicles attempting to enter and exit the lot. Species adversely affected in the Conlon Lot from expansion would include bay laurel and sword fern. Adverse impacts on California bottlebrush grass or leopard lily are not anticipated because a rare plant survey would be conducted prior to any construction activities. However, if state or locally listed plants are found and cannot be avoided, these plants would be transplanted or seeds would be collected, propagated, and replanted in another location.

Approximately 1,200 linear feet of vegetation would be removed to develop a new woodland pedestrian trail between the Annex and Nursery Lots, resulting in long-term, adverse impacts on arroyo willow, bay laurel, and coast live oak. Similar to the impacts in the former Nursery Area, the new trail could potentially affect California buckeye, but removal would be avoided where possible. Approximately 1,500 feet of the existing pedestrian trail along Muir Woods Road between the Main and Nursery Lots would be decommissioned and revegetated with plants native to the monument, resulting in long-term, beneficial impacts on vegetation.

Similar to alternative 2, staging and stockpiling construction equipment and fill material would result in trampling, vegetation loss, and the increased potential for the spread of invasive, nonnative plants and diseases; the installation of interpretive media and wayfinding signs along trails and traffic signage along Muir Woods Road would uproot or maintain the height of vegetation; the Dipsea Trail realignment and construction of a footbridge over Redwood Creek would increase the potential for

loss of riparian vegetation; and the construction of infiltration trenches near each parking lot would remove vegetation. These actions would result in direct, long-term, adverse impacts on vegetation.

Similar to alternative 2, approximately 0.4 acre of the Entry Plaza would be rehabilitated with plants native to the monument. This action would keep the soil and seed bank stabilized in the erosion hazard area, reduce the movement of silt, keep the water temperature of Redwood Creek cooler, and increase the availability of food and nesting habitat for a variety of wildlife species. Additionally, an increase in vegetation would result in a reduction in nutrient and chemical pollution by trapping and filtering these substances before they enter Redwood Creek. However, constructing a new restroom in the Entry Plaza would likely remove vegetation within its respective footprint, resulting in direct, long-term, adverse impacts. Approximately 0.2 acre of the former roadside parking area designated in alternatives 1 and 2 would be revegetated with plants native to the monument.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 3 would result in limited short and long-term, adverse impacts in localized areas affected by management actions; these impacts would be minimized through mitigation. Overall long-term benefits would result from rehabilitation and revegetation of disturbed areas. Therefore, when the primarily beneficial impacts as a result of alternative 3 are combined with the beneficial effects of other cumulative actions in the project area, an overall long-term, beneficial cumulative impact on vegetation is expected.

**Conclusion.** Under alternative 3, direct, adverse impacts would occur from removing vegetation in the former Nursery Area, Conlon Lot, and along the new pedestrian woodland trail and pruning low-hanging branches along Muir Woods Road and from disturbance to the riparian area of Redwood Creek. Direct mortality of plants would also occur in the footprints of the lift station, new restrooms, and infiltration trenches. However, the revegetation of the existing pedestrian trail along Muir Woods Road, riparian rehabilitation in the Entry Plaza, and revegetation of the former roadside parking area would result in long-term, beneficial impacts. No impacts on rare plants are anticipated because a survey would be conducted prior to any construction activities. Alternative 3 would primarily contribute a beneficial increment to cumulative impacts, resulting in an overall beneficial cumulative impact on vegetation.

## **WATER RESOURCES AND HYDROLOGIC PROCESSES**

### **Methodology and Assumptions**

This analysis of potential impacts on water resources and hydrologic processes focuses on impacts on groundwater, surface water, wetlands, water quality, and floodplains within the monument and water resources that are hydrologically connected, including the downstream reaches of Redwood Creek. Potential impacts on these resources could result from alterations or disturbance to each resource, including changes to quality, quantity, or associated functions and values. Analysis of potential impacts was based on a review of existing literature, data, maps, and professional judgment.

### **Impacts of Alternative 1: No Action**

**Analysis.** Under alternative 1, current management actions would continue, and existing uses, developments, and facilities would remain the same. Roadside parking would exist along Muir Woods Road, and stormwater management infrastructure, including damaged or inadequately sized culverts, would not be improved, thereby continuing to contribute a higher volume of water, sediment, and other pollutants to the creek during rain events. Ground disturbance in the former

Nursery Area, shoulder parking along portions of Muir Woods Road, and the location of the Muir Woods Road pedestrian trail would remain, allowing for potential sedimentation of local water resources. The wooden plank over Redwood Creek along the Dipsea Trail would remain as a pedestrian crossing, as would the frequent inadvertent foot traffic through the creek instead of over the wooden plank, resulting in creek bed disturbance, increased erosion and sedimentation, and hydrologic disturbance during high flows. Therefore, alternative 1 would result in direct and indirect, long-term, adverse impacts on surface water, water quality, and hydrologic processes as a result of continued sediment erosion and runoff from road shoulders and parking lots and instream disturbance. The existing management actions do not pollute the groundwater or impede groundwater recharge, therefore, there would be no impacts on these resources.

**Cumulative Impacts.** The reservation system will restrict the number of vehicles parking along Muir Woods Road, which will reduce ground disturbance and the potential for erosion and sediment loading to local waters. The installation of road parking barriers along Muir Woods Road used fiber roll or wattle matting next to culverts to prevent the transport of sediment or other construction-related pollutants into the drainages and to stabilize disturbed ground. The barrier system avoided all culverts that crossed the road by leaving a 10-foot opening on either side of the culvert. The barrier system prevents parking along the shoulder of Muir Woods Road. Installation of erosion and sediment control measures and culvert avoidance minimize and prevent sediment and other pollutants from entering local streams, resulting in short-term, beneficial impacts on water resources. Therefore, this action will continue to result in short- and long-term, beneficial impacts on water resources by eliminating ground disturbance and potential sediment loading.

The Muir Woods Road Bridge Replacement Project would affect the surface water and hydrologic processes of Redwood Creek. The replacement of the bridge, improvements to Muir Woods Road adjacent to the bridge, and realignment of the road would disturb soils and increase the potential for soil erosion and associated sedimentation of Redwood Creek. Initial actions to remove and replace the existing bridge would temporarily alter creek flow; however, protection of the riparian habitat along the creek would be a project priority. The project would adhere to applicable erosion and sediment control regulations and implement best management practices and other sediment barriers to control runoff into the creek. Therefore, the project would result in short-term, adverse impacts on water resources from degradation of water quality from increased sediment loads and alteration of hydrologic processes. After construction of the Muir Woods Road Bridge, the added impervious surface would increase the volume of stormwater entering Redwood Creek and road-related sediment and pollutant loading, resulting in long-term, adverse impacts on water resources.

The Muir Woods Road Rehabilitation Project would involve resurfacing portions of Muir Woods Road and repairing or replacing a number of culverts. The application of road resurfacing materials and use of associated equipment has the potential to accidentally release hazardous materials to the ephemeral drainages; however, impacts would be minimized through the implementation of best management practices and appropriate hazardous material use and storage. The repair or replacement of culverts would temporarily disturb the flow of the associated drainages and increase the potential for sediment to enter the drainages and Redwood Creek. During construction, impacts on water resources and hydrologic processes would be short term and adverse as a result of flow alteration and sediment and pollutant loading; however, the use of best management practices and erosion and sediment control measures would capture sediment runoff, and implementation of a stormwater pollution prevention plan during construction would minimize sediment transport. After construction is complete, the culverts would help to decrease the amount of sediment entering Redwood Creek and improve water quality, resulting in long-term, beneficial impacts on water resources.

The Muir Woods Water and Wastewater Service Rehabilitation Project would involve replacing and/or rehabilitating water and wastewater infrastructure, relocating infrastructure away from Redwood Creek and outside the erosion hazard area. Construction would disturb and expose soils, which could increase the potential for soil erosion, sedimentation of surrounding water resources, and accidental release of hazardous materials. Ground disturbance during construction could also temporarily alter localized surface water drainage. The project would be required to develop a stormwater pollution prevention plan and implement best management practices for stormwater, sediment and erosion control, and waste management. Dewatering would be necessary if high groundwater levels were encountered. The project could result in short-term, adverse impacts on water resources and hydrologic processes as a result of potential water quality and drainage issues. Compliance with necessary stormwater permits and stormwater pollution prevention plans would minimize potential short-term, adverse impacts and prevent long-term impacts.

The Redwood Creek Trail Realignment and Dias Ridge Trail Extension Project would move existing trails outside the floodplain and remove culverts, fords, and abandoned bridges within the Redwood Creek Watershed. Construction activities would temporarily disturb the ground and the creek bed and banks and increase the potential for soil erosion and sediment transport into Redwood Creek, resulting in short-term, adverse impacts on water resources. Although impacts associated with added sediment during construction or removal activities would be temporary and adverse, the project would result in overall long-term, beneficial impacts on water resources from trail repairs that would prevent erosion, improve water quality, and restore floodplains.

The Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project would entail replacing pedestrian bridges over Redwood Creek, repairing existing dirt trails, removing riprap from the creek banks, and installing large woody debris (NPS 2017b). Additionally, grade control would be installed in a small, incised tributary on the east side of Redwood Creek. Dismantling and replacing the pedestrian bridges would disturb the ground and the creek bed and banks and increase the potential for soil erosion and sediment transport into Redwood Creek, resulting in short-term, adverse impacts on water resources. The environmental assessment for the project states that the removal of existing riprap and installation of large woody debris would increase downstream turbidity as well as sedimentation and erosion in the project area resulting in short- and long-term, adverse impacts; however, these impacts would likely diminish over time as the creek achieves its new dynamic equilibrium (NPS 2017b). Although impacts associated with added sediment during construction and installation would be temporary and adverse before the creek reaches equilibrium, the project would eventually result in overall long-term, beneficial impacts from placing large woody debris, installing grade controls on the tributary, and the revegetating exposed areas near the creek channel that would stabilize the creek banks and prevent erosion.

The cumulative actions would have adverse effects on water quality and hydrology; however, these effects would be relatively limited and localized compared to the more widespread benefits from the elimination of ground disturbance and the installation of stormwater management and erosion and sediment control measures. The overall impacts from these cumulative actions would be beneficial. Alternative 1 would contribute adverse effects to the cumulative actions because of sedimentation from continuing ground and instream disturbance and erosion and altered hydrology from high runoff volumes. These water quality and hydrologic impacts would be widespread within the monument and downstream. Therefore, when the primarily widespread adverse impacts from alternative 1 are combined with the effects of other cumulative actions in the project area, an overall adverse cumulative impact is expected.

**Conclusion.** Under alternative 1, impacts on water resources and hydrologic processes would continue to be direct and indirect, long term, and adverse from ongoing sediment erosion and runoff

from disturbed road shoulders and parking lots and inadequate stormwater management infrastructure that contribute sediment, water volume, and pollutants to local waterways. Instream disturbances would also contribute to sediment and alter local hydrology. The contribution of alternative 1 to the cumulative impacts would be appreciable because of the potential alteration of water quality and hydrology in the monument and downstream of Redwood Creek, resulting in an overall adverse cumulative impact.

## **Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements**

**Analysis.** Under alternative 2, the addition of wayfinding signs and interpretive media and accommodation of buses, shuttles, commercial use vehicles, and ABA-compliant parking in the Main Lot would have no impacts on water resources and hydrologic processes. Additionally, because no changes to existing trail access between parking areas and the Entry Plaza would occur, impacts would be the same as those described under alternative 1.

Realignment of the Dipsea Trail, construction of a footbridge over Redwood Creek, and ground disturbance and potential bank disturbance would increase the potential for soil erosion and sediment transport into Redwood Creek. Best management practices to control stormwater and erosion and sediment would be implemented to minimize adverse impacts. After construction, the placement of the footbridge would not disturb the creek bed, although some structural parts of the bridge may be located close to the creek banks and in the adjacent erosion hazard area. No impacts are expected on the floodplain because the bridge would be constructed approximately 14 feet above the creekbed, at the same grade as the Annex Lot, to avoid flooding and to account for the potential future migration of the creek channel, resulting in no adverse impacts on hydrologic processes. Construction of the new footbridge would result in direct, short-term, adverse impacts from potential sedimentation but would eliminate the existing instream foot traffic and associated erosion and water quality issues, resulting in direct, long-term, beneficial impacts on water resources and hydrologic processes.

The existing restroom in the Entry Plaza would be relocated from within the erosion hazard area close to Redwood Creek to a position outside the erosion hazard area. During the removal and relocation process, soils would be exposed, which could increase the potential for soil erosion, sedimentation of surrounding water resources, and accidental release of hazardous materials. During relocation, impacts could be indirect, short term, and adverse; however, best management practices would be implemented to control stormwater, erosion and sediment, and accidental releases of construction-related pollutants to minimize impacts. After the restroom is relocated, impacts would be direct, long term, and beneficial from the removal of potential flooding hazards and allowing the erosion hazard area to slow potential high flows that overtop the banks of Redwood Creek.

The construction of a new restroom near the former Nursery Area would expose soils and lead to increased potential for soil erosion, sedimentation of surrounding water resources, and accidental release of hazardous materials. The project would result in indirect, short-term, adverse impacts; however, best management practices would be implemented to control stormwater, erosion and sediment, and accidental releases of construction-related pollutants to minimize impacts on water quality.

The part of the Entry Plaza within the erosion hazard area would be rehabilitated through revegetation with native riparian plant species. The revegetated area would reduce the volume of stormwater runoff into Redwood Creek and improve hydrology by helping to reduce peak streamflow. The rehabilitated erosion area would also help slow and store high flood flows that

overtop the creek banks. Therefore, this action would result in direct, long-term, beneficial impacts on water resources and hydrologic processes.

Revegetation of portions of the former Nursery Area with native plant species would stabilize the exposed soils and prevent erosion and transport of soils into local waterways. This would improve the water quality of the creek. Additionally, the reestablishment of vegetation would help to slow and capture any overbank flows from Redwood Creek or overland stormwater runoff before entering Redwood Creek. Reducing runoff into the creek would attenuate peak storm flows and minimize streambed and bank erosion. Revegetation of disturbed areas would result in indirect, long-term, beneficial impacts on water resources and hydrologic processes.

Expansion of the Annex and Conlon Lots would require clearing and ground disturbance of less than 0.3 acre. Soil exposure and the use of construction equipment would increase the potential for erosion, sediment loading into Redwood Creek, and the accidental release of hazardous materials. Best management practices would be implemented during construction to minimize impacts from stormwater, erosion and sediment, and hazardous materials. Stormwater management infrastructure would be upgraded to improve water quality, quantity, and drainage. Two culverts would be constructed at the Annex Lot to convey the flow of existing ephemeral drainages, which would result in temporary direct, adverse impacts from altered drainage during construction with overall long-term benefits. Stormwater management measures, including infiltration trenches and buffer strips, would be designed and constructed to meet applicable water quality standards. Although impervious surface would increase under this alternative, the implementation of these facilities would have benefits from reducing the volume of and treating the stormwater runoff to at least pre-project levels, or better, from all the parking lots and eliminating long-term, adverse impacts. The location, size, spacing, capacity, and other details concerning the stormwater management infrastructure would be determined during the design phase. Therefore, the project would result in direct, short-term, adverse impacts on water resources and hydrologic processes during construction and direct, long-term, beneficial impacts after construction is completed.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 2 would result in limited, short-term, adverse impacts in localized areas affected by management actions; however, the effects of these impacts would be minimized through mitigation measures described in chapter 2. Overall long-term, beneficial impacts would result from revegetation and rehabilitation of disturbed areas and updated stormwater management. Therefore, when the beneficial impacts from alternative 2 are combined with the beneficial effects of other cumulative actions in the project area, an overall long-term, beneficial cumulative impact is expected.

**Conclusion.** Under alternative 2, management actions are expected to contribute minimal, temporary, adverse impacts during construction from alterations to water quality and localized drainage impacts. Over time, these actions would contribute beneficial impacts from revegetation and rehabilitation of disturbed areas and updated stormwater management and would result in an overall long-term, beneficial cumulative impact within the monument and downstream. Compared to alternative 1, alternative 2 would improve water resources and hydrologic processes, including water quality conditions, over time by reducing adverse impacts from continuing ground disturbance and inadequate stormwater management infrastructure and adding improvements.

### **Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements**

**Analysis.** Under alternative 3, impacts from realigning the Dipsea Trail and constructing the footbridge, relocating or constructing restrooms, and rehabilitating the Redwood Creek erosion



hazard area in the Entry Plaza would be the same as those described under alternative 2. Establishing additional wayfinding signs and interpretive media and accommodating buses, shuttles, commercial use vehicles, and ABA-compliant parking in the Main Lot would have no impacts on water resources and hydrologic processes.

Installing a new woodland pedestrian trail between the Annex and Nursery Lots would require approximately 1,200 linear feet of clearing and grubbing and the construction of small footbridges over the existing intermittent drainages located along the trail route. Ground disturbance, including potential bank disturbance associated with the intermittent drainages, would increase the potential for soil erosion and sediment transport into surrounding surface waters. Therefore, construction of the new trail and footbridges over drainages would result in direct, short-term, adverse impacts from potential sedimentation; however, best management practices for stormwater and erosion and sediment control would be implemented to minimize impacts from water quality degradation.

Decommissioning the Muir Woods Road pedestrian trail would eliminate ground disturbance from foot traffic along the trail and associated potential sediment loading, resulting in long-term, indirect, beneficial impacts.

Revegetating the disturbed area of the existing roadside parking area and the Muir Woods Road pedestrian trail with native plant species would stabilize the exposed soils and prevent erosion and transport of soils into local waterways, which would improve the water quality of surrounding surface waters. Additionally, reestablishing vegetation would help to slow and capture any overland stormwater runoff before entering Redwood Creek or ephemeral drainages. Reducing runoff into the waterways would attenuate peak storm flows and minimize streambed and bank erosion. Therefore, revegetation of disturbed areas would result in direct, long-term, beneficial impacts on water resources and hydrologic processes.

Parking lot expansion and the development of engineered stormwater management infrastructure would be similar to alternative 2. Under this alternative, the Conlon Lot expansion would be the same as under alternative 2, resulting in similar indirect, short-term, adverse impacts from potential increased sediment and pollutant loading to surface waters during construction. Infiltration trenches and buffer strips would be constructed to reduce the volume of, and treat the stormwater runoff from, all parking lots, which would result in beneficial impacts. Although impervious surface would be increased, the implementation of infiltration trenches and buffer strips would allow the areas to retain runoff volume, velocity, and water quality at pre-project levels, if not better. One culvert would be constructed in the Nursery Lot to convey the flow of an existing ephemeral drainage. The location, size, spacing, capacity, and other details concerning the stormwater management infrastructure would be determined during the design phase. Direct, short-term, adverse impacts from alteration of the drainage would result during construction but in the long term, impacts would be direct and beneficial from improved stormwater flow. Therefore, the stormwater improvements under alternative 3 would result in direct, short-term, adverse impacts on water resources and hydrologic processes during construction and direct, long-term, beneficial impacts after completion.

The development of the lift station and adjoining restrooms, underground power and force main lines, and the Nursery Lot would require removing existing structures, clearing vegetation, and installing impervious surfaces. During construction and excavation, ground disturbance would result in indirect, short-term, adverse impacts from increased potential for erosion, sediment loading, and accidental releases of hazardous materials. Dewatering would be necessary if high groundwater levels were encountered. Temporary, direct, adverse impacts on water resources and hydrological processes would occur from culvert installation to convey flow from an existing on-site drainage. Impervious pavement or structures would be placed on approximately 0.4 acre of previously

disturbed and compacted ground. Implementation of best management practices and the stormwater pollution prevention plan would minimize potential short-term, adverse impacts, and stormwater management infrastructure discussed above would prevent long-term, adverse impacts on hydrology and water quality from the added impervious surface.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 3 would result in limited, short-term, adverse impacts in localized areas affected by management actions; these impacts would be minimized through mitigation. Overall long-term benefits would result from the removal of areas of continued disturbance, revegetation and rehabilitation of disturbed areas, and updated stormwater management. Therefore, when the beneficial impacts associated with alternative 3 are combined with the beneficial effects of other cumulative actions in project area, an overall long-term, beneficial cumulative impact is expected.

**Conclusion.** Under alternative 3, management actions are expected to contribute minimal, temporary, adverse impacts during construction from alterations to water quality and localized drainage impacts. Over time, these actions would contribute substantial, beneficial impacts from the removal of large areas of continued disturbance, revegetation and rehabilitation of disturbed areas, and updated stormwater management and would result in an overall long-term, beneficial cumulative impact experienced within the monument and downstream. Compared to alternative 1, alternative 3 would greatly improve water resources and hydrologic processes, including water quality conditions by reducing adverse impacts from continuing ground disturbance and inadequate stormwater management infrastructure and adding improvements.

## THREATENED AND ENDANGERED SPECIES

### Methodology and Assumptions

This analysis examines the potential for actions associated with each of the alternatives to affect threatened or endangered species or their habitats at the monument. Threatened and endangered species known to occur or potentially occurring at the monument are identified in chapter 3. The area of analysis includes all habitats within the boundary of the monument. However, any impacts on coho salmon or steelhead trout associated with impacts on water quality may extend outside the boundaries of the monument to downstream reaches of Redwood Creek.

### Impacts of Alternative 1: No Action

#### Analysis.

*Coho Salmon* — Under alternative 1, coho salmon and their critical habitat would be indirectly affected commensurate with impacts on water quality as described under “Water Resources and Hydrologic Processes.” Sedimentation, pollution, and instream erosion associated with high volumes of stormwater runoff that enter the creek following rainfall events would continue to affect water quality and habitat conditions in Redwood Creek. These impacts would persist over time because roadside parking would continue, and stormwater management infrastructure (including damaged or undersized culverts) would not be upgraded. The wooden plank over Redwood Creek along the Dipsea Trail would remain in place and continue to serve as a crossing over the creek, potentially resulting in direct disturbances to coho salmon habitat if visitors walk through the creek instead of on the plank. Overall, alternative 1 may affect but is not likely to adversely affect coho salmon. Potential effects could be direct or indirect over the long term but would not represent a substantial change from existing conditions.

*Steelhead Trout* — Impacts on steelhead trout under alternative 1 would be the same as those described for coho salmon because of the habitat overlap between the two species.

*Northern Spotted Owl* — Alternative 1 would not disturb northern spotted owls or their habitats because no construction would occur. Therefore, no impacts on this species are anticipated.

*Marbled Murrelet* — The marbled murrelet has not been documented at the monument, despite the presence of suitable nesting habitat. Therefore, alternative 1 would have no impact on this species.

*California Red-Legged Frog* — The California red-legged frog has not been documented at the monument and is not likely to be present because of a lack of suitable breeding habitat. Therefore, alternative 1 would have no impact on this species.

**Cumulative Impacts.** Phase 1 of the reservation system indirectly benefited coho salmon and steelhead trout by preventing or reducing the amount of parking along the shoulder of Muir Woods Road. Erosion as a result of roadside parking had previously contributed to sediment loading and degradation of water quality in Redwood Creek. Erosion and sediment control measures were also installed as part of the project, and these measures have further reduced the potential for water quality and habitat degradation in Redwood Creek. Indirect, beneficial impacts on coho salmon and steelhead trout associated with this project are expected to continue over the long term. This project did not likely affect northern spotted owls or marbled murrelet. Furthermore, the reservation system will reduce the amount of parking along Muir Woods Road, completely eliminating parking south of the Muir Woods Road Bridge. This will potentially improve water quality and habitat conditions for coho salmon and steelhead trout in Redwood Creek by reducing or preventing erosion and sedimentation associated with roadside parking. The agencies will consult under the Endangered Species Act on any potential impact to listed species as warranted.

Activities associated with the Muir Woods Road Bridge Replacement Project would have indirect, short-term impacts on coho salmon and steelhead trout commensurate with impacts on water quality in Redwood Creek. Replacement of the bridge would result in short-term increases in sediment loading from ground disturbances and would temporarily alter the flow of Redwood Creek. These impacts would be minimized by implementing sediment barriers and other best management practices; protection of riparian habitat along Redwood Creek would be a priority. This project would result in indirect, short-term impacts on northern spotted owls because of increased noise disturbances during construction. The project would not affect marbled murrelet because this species has not been documented at the monument, and no disturbances to old-growth forest habitat are expected to occur. The project would not affect the California red-legged frog because this species is not likely to occur in the project area.

Road resurfacing and culvert replacement for the Muir Woods Road Rehabilitation Project would have indirect, short-term impacts on coho salmon and steelhead trout because of the increased potential for runoff and sedimentation associated with ground disturbances. These impacts would be minimized by implementing sediment barriers and other best management practices. The project would have indirect, long-term, beneficial impacts on coho salmon and steelhead trout because road slides would be repaired and two culverts would be replaced (within the project area), resulting in decreased erosion and sedimentation in Redwood Creek. This project could result in indirect, short-term impacts on northern spotted owls because of increased noise disturbances during construction. The project would not affect marbled murrelet because this species has not been documented at the monument, and no disturbances to old-growth forest habitat are expected to occur. The project would not affect the California red-legged frog because this species is not likely to occur in the project area.

The Muir Woods Water and Wastewater Rehabilitation Project would entail rehabilitating water and wastewater lines at the monument. Ground disturbance and construction activities associated with the proposed improvements could result in indirect, short-term impacts on coho salmon and steelhead trout because of runoff and sedimentation in Redwood Creek. Implementation of best management practices and compliance with any necessary stormwater permits and stormwater pollution prevention plans would minimize impacts on these species. Baseline conditions would be restored once the project is completed. Increased noise during construction could result in indirect, short-term impacts on northern spotted owls. Vegetation clearing, including tree removal, if necessary, would be timed to avoid northern spotted owl nesting season to minimize impacts on this species. The project would not affect marbled murrelet because this species has not been documented at the monument, and no disturbances to old-growth forest habitat are expected to occur. The project would not affect the California red-legged frog because this species is not likely to occur in the project area.

The Redwood Creek Trail Realignment and Dias Ridge Trail Extension Project would involve realigning the Redwood Creek Trail and removing existing culverts and bridges, which contributed to the build-up of fine sediment and degraded water quality and aquatic habitat in Redwood Creek. Vegetation clearing and ground disturbance during construction and infrastructure removal activities could result in indirect, short-term impacts on coho salmon and steelhead trout from runoff and sedimentation in Redwood Creek. Implementing best management practices would minimize temporary impacts, and reducing sediment discharge to Redwood Creek is expected to improve water quality and aquatic habitat conditions over the long term, resulting in beneficial impacts on coho salmon and steelhead trout. Increased noise during construction could result in indirect, short-term impacts on northern spotted owls. The project would not affect marbled murrelet because this species has not been documented at the monument, and no disturbances to old-growth forest habitat are expected to occur. The project would not affect the California red-legged frog because this species is not likely to occur in the project area.

The Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project would entail replacing four pedestrian bridges, restoring natural stream processes in Redwood Creek by removing riprap, and enhancing juvenile coho salmon habitat by placing large woody debris in Redwood Creek. This project would result in direct, short-term impacts on coho salmon and steelhead trout, followed by direct, long-term, beneficial impacts. Short-term impacts would consist of habitat disturbance and temporary increases in turbidity during bridge replacement, riprap removal, and placement of large woody debris in the creek. These impacts would be localized and conditions would return to baseline as natural stream processes are restored (NPS 2017b). Habitat restoration and enhancement activities, including placing woody debris in Redwood Creek, would benefit both coho salmon (especially at the juvenile stage) and steelhead trout. Increased noise during bridge replacement and riprap removal could temporarily disturb northern spotted owls but is not likely to result in adverse impacts. The project would not affect marbled murrelet because this species has not been documented at the monument, and no disturbances to old-growth forest habitat are expected to occur. The project would not affect the California red-legged frog because this species is not likely to occur in the project area.

Cumulative actions would have direct and indirect, short- and long-term impacts on threatened and endangered species. Most impacts on coho salmon and steelhead trout would be indirect and temporary, commensurate with impacts on water quality in Redwood Creek. These impacts would be followed by long-term, beneficial impacts associated with reduced erosion and sedimentation and restoration and enhancement of aquatic habitat in Redwood Creek. Impacts on northern spotted owl would be indirect and short term, potentially resulting from noise disturbances during construction activities. Conditions would quickly return to baseline once construction is completed.

The cumulative actions would not affect marbled murrelet because this species has not been documented at the monument, and no disturbances to old-growth forest habitat are expected to occur. The cumulative actions would not affect the California red-legged frog because this species is not likely to occur in the project area. When the impacts from alternative 1 are combined with the effects of other cumulative actions in the study area, threatened and endangered species would not be likely to be adversely affected. Alternative 1 would contribute an increment to the overall cumulative impact because of continued water quality and habitat degradation in Redwood Creek associated with inadequate parking and stormwater management infrastructure.

**Conclusion.** Under alternative 1, critical habitat for coho salmon and steelhead trout would continue to be affected by erosion, sedimentation, and water quality degradation associated with inadequate parking and stormwater management infrastructure and the continued use of the wooden plank crossing Redwood Creek on the Dipsea Trail. Direct and indirect impacts would persist in the long term, but would not represent a substantial change from existing conditions. Alternative 1 would not affect northern spotted owl, marbled murrelet, and California red-legged frog. Overall, alternative 1 is not likely to adversely affect threatened or endangered species. Cumulative impacts would be beneficial, and alternative 1 would contribute an increment to the overall cumulative impact.

## **Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements**

### **Analysis.**

*Coho salmon* — Under alternative 2, realignment of the Dipsea Trail and construction of a footbridge over Redwood Creek may result in indirect, temporary impacts on coho salmon habitat as a result of increased sedimentation associated with ground disturbance during construction. However, implementation of best management practices would minimize these impacts. Construction of a footbridge over Redwood Creek would have long-term, beneficial impacts on coho salmon and their critical habitat because Dipsea Trail users would have a formal bridge to use and would not disturb habitat in Redwood Creek by using the existing wooden plank crossing or walking through the creek.

Relocation of the restroom in the Entry Plaza and construction of a new restroom in the former Nursery Area would have indirect, temporary impacts on coho salmon and their critical habitat, commensurate with water quality impacts in Redwood Creek. Ground disturbance during construction would temporarily increase sedimentation. Best management practices would minimize these impacts and disturbed areas would be revegetated following construction, resulting in long-term, beneficial impacts. Similarly, rehabilitation of riparian habitat in the Redwood Creek erosion hazard area of the Entry Plaza may result in temporary impacts on coho salmon and their critical habitat associated with ground disturbance. However, rehabilitation of riparian habitat would improve water quality over the long term by reducing erosion, resulting in indirect, beneficial impacts on coho salmon and their critical habitat.

Expansion of the Annex and Conlon Lots could result in indirect, temporary impacts on coho salmon and their critical habitat from increased sedimentation from ground disturbance during construction. However, stormwater management infrastructure, including the installation of two new culverts, infiltration trenches, and buffer strips would have indirect, long-term, beneficial impacts on coho salmon and their habitat, commensurate with improved water quality in Redwood Creek.

Overall, alternative 2 may affect but is not likely to adversely affect coho salmon. Potential impacts would be indirect and temporary, resulting from increased sedimentation associated with ground disturbance during construction. However, these impacts would be minimized through the implementation of mitigation measures and best management practices, and therefore would not be significant. Reduced erosion and sedimentation and improved water quality in Redwood Creek as a result of improved stormwater management infrastructure, construction of a footbridge over Redwood Creek, revegetation of disturbed areas such as the former Nursery Area, and rehabilitation of riparian habitat in the Entry Plaza would result in direct and indirect, long-term, beneficial impacts on coho salmon and their habitat.

*Steelhead Trout* — Impacts on steelhead trout under alternative 2 would be the same as those described for coho salmon because of the habitat overlap between the species.

*Northern Spotted Owl* — Under alternative 2, noise and the presence of equipment and crews during construction activities could result in direct, temporary impacts on northern spotted owls. These impacts could occur during parking lot expansion, installation of stormwater management infrastructure, restroom construction and relocation in the former Nursery Area and Entry Plaza, and construction of the Dipsea Trail footbridge over Redwood Creek. If owls are present near construction activities, noise or visual disturbances could cause individuals to flush the area, potentially resulting in disruptions to feeding, nesting, or breeding behavior. However, temporarily displaced individuals would likely return to their habitat once construction activities are complete. Parking lot expansion would result in the loss of approximately 0.2 acre of potential northern spotted owl foraging habitat, resulting in a long-term impact. This would not represent a substantial loss in overall potential foraging habitat at the monument, given the small amount of loss. If present in the project area, northern spotted owls would likely forage in adjacent habitats.

Most impacts would be avoided by seasonal and hourly restrictions on construction activities and other best management practices designed to avoid, minimize, or mitigate impacts on threatened and endangered species. No construction activities would occur at night or during dawn or dusk to avoid times when northern spotted owls are most active.

Rehabilitation of approximately 0.4 acre of riparian habitat in the Redwood Creek erosion hazard area of the Entry Plaza would have direct, long-term, beneficial impacts on the northern spotted owl, which is associated with this habitat type. Therefore, alternative 2 may affect but is not likely to adversely affect northern spotted owls.

*Marbled Murrelet* — The marbled murrelet has never been documented at the monument, although old-growth forest habitat, which is suitable for nesting, does exist at the monument. Alternative 2 would not result in the destruction or degradation of marbled murrelet habitat. Therefore, alternative 2 would have no impact on this species.

*California Red-Legged Frog* — The California red-legged frog has not been documented at the monument, and is not likely to be present because of a lack of suitable breeding habitat. However, ground disturbance associated with installation of the Dipsea Trail footbridge and culvert replacements would occur in areas that provide potentially suitable dispersal, foraging, and sheltering habitats. These activities could result in temporary impacts on the California red-legged frog in the unlikely event that this species is present during construction activities. Reduction of untreated stormwater runoff into Redwood Creek, stabilization of erosion hazard areas, and revegetation of portions of the Entry Plaza would result in long-term, beneficial impacts on California red-legged frog non-breeding habitat. Therefore, alternative 2 may affect but is not likely to adversely affect the California red-legged frog.

**Cumulative Impacts.** Cumulative Impacts from past, present, and reasonably foreseeable future actions would be the same as those described for alternative 1. When the impacts from alternative 2 are combined with the effects of other cumulative actions in the study area, an overall beneficial cumulative impact is expected. Alternative 2 would contribute a beneficial increment to the overall cumulative impact as a result of stormwater infrastructure improvements, which would improve habitat and water quality in Redwood Creek, and rehabilitation of riparian habitat in the Entry Plaza.

**Conclusion.** Alternative 2 would result in indirect, temporary impacts on coho salmon and steelhead trout from increased sedimentation and water quality degradation associated with ground disturbance during construction activities. Construction of the Dipsea Trail footbridge over Redwood Creek, revegetation of disturbed areas, and improvements to stormwater management infrastructure would have direct and indirect, long-term, beneficial impacts on coho salmon and steelhead trout because of improved water quality and reduced habitat disturbances associated with foot traffic on the Dipsea Trail at the Redwood Creek crossing. Northern spotted owls could potentially be directly and temporarily affected by noise and other disturbances associated with construction activities, although most impacts would be avoided by seasonal and hourly restrictions. Rehabilitation of riparian habitat in the Entry Plaza would have long-term, beneficial impacts on the northern spotted owl. Alternative 2 would have no effect on marbled murrelet because this species has not been documented at the monument, and no disturbances to old-growth forest habitat would occur. Alternative 2 may affect but is not likely to adversely affect the California red-legged frog because this species has not been documented at the monument, and is not likely to be present due to a lack of suitable breeding habitat. Overall, alternative 2 may affect but is not likely to adversely affect threatened or endangered species. Under alternative 2, all potential impacts would be avoided, minimized, or mitigated by the implementation of best management practices. Cumulative impacts would be beneficial. Alternative 2 would contribute a beneficial increment to the overall cumulative impact.

### Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements

#### Analysis.

*Coho Salmon* — Under alternative 3, impacts on coho salmon and their critical habitat associated with realigning the Dipsea Trail and constructing a footbridge over Redwood Creek, relocating restroom facilities in the Entry Plaza and constructing a new restroom in the former Nursery Area, and rehabilitating riparian habitat in the Entry Plaza would be the same as those described under alternative 2. These impacts would be direct and indirect and would be both temporary and long term. Impacts would be commensurate with changes in water quality in Redwood Creek and reduced habitat disturbance from foot traffic at the Dipsea Trail crossing.

Under alternative 3, activities associated with the expansion of the Conlon Lot would be the same as those described for alternative 2, resulting in similar indirect, short-term impacts commensurate with changes in water quality in Redwood Creek. The development of the lift station and adjoining restrooms, underground power and force main lines, and the Nursery Lot would require removing existing structures, clearing vegetation, and installing impervious surfaces. Runoff and sedimentation associated with ground disturbances during construction and excavation activities could result in indirect, short-term impacts on critical habitat for coho salmon from water quality degradation. Implementation of best management practices would minimize these impacts, and conditions would be expected to return to baseline once construction is completed. Upgrades to stormwater management infrastructure, including the installation of one new culvert in the former Nursery Area, infiltration trenches, and buffer strips would have indirect, long-term, beneficial impacts on coho salmon and their habitat, commensurate with improved water quality in Redwood Creek.



Installing a new woodland pedestrian trail between the Annex and Nursery Lots would result in indirect, temporary impacts on coho salmon and their critical habitat, from increased sedimentation and reduced water quality in Redwood Creek as a result of ground disturbance during construction. However, decommissioning the Muir Woods Road pedestrian trail would have indirect, long-term, beneficial impacts on coho salmon and their habitat because of decreased erosion from foot traffic, resulting in improved water quality in Redwood Creek.

Revegetation of the Muir Woods Road pedestrian trail and roadside parking areas would have indirect, long-term, beneficial impacts on coho salmon and their critical habitat commensurate with improved water quality and reduced erosion and sedimentation.

Overall, alternative 3 may affect but is not likely to adversely affect coho salmon. Potential impacts would be indirect and temporary, commensurate with impacts on water quality in Redwood Creek. However, these impacts would be minimized with the implementation of best management practices, and therefore would not be significant. Reduced erosion and sedimentation and improved water quality in Redwood Creek as a result of improved stormwater management infrastructure, construction of a footbridge over Redwood Creek, revegetation of disturbed areas, and rehabilitation of riparian habitat in the Entry Plaza would result in direct and indirect, long-term, beneficial impacts on coho salmon and their habitat.

*Steelhead Trout* — Impacts on steelhead trout under alternative 3 would be the same as those described for coho salmon because of the habitat overlap between the species.

*Northern Spotted Owl* — Under alternative 3, impacts on the northern spotted owl would be similar to those described under alternative 2. Potential impacts on northern spotted owls would consist of temporary disturbances to individuals because of noise and the presence of equipment and crews during construction activities and minimal loss of foraging habitat from the Conlon Lot expansion.

Temporary impacts associated with expansion of the Conlon Lot, restroom relocation in the Entry Plaza, and construction of a footbridge over Redwood Creek would be the same as those described for alternative 2, and impacts from the installation of stormwater management infrastructure would be very similar. Noise and visual disturbances associated with development of a parking lot and lift station in the former Nursery Area may affect northern spotted owls, but is not likely to adversely affect the owls. Impacts could occur wherever owls are present near construction activities.

Most impacts would be avoided by seasonal and hourly restrictions on construction activities and other best management practices designed to avoid, minimize, or mitigate impacts on threatened and endangered species. No construction activities would occur at night or during dawn or dusk to avoid times when northern spotted owls are most active. Temporarily displaced individuals would likely return to their habitat once construction activities are completed.

Rehabilitation of approximately 0.4 acre of riparian habitat in the Redwood Creek erosion hazard area of the Entry Plaza would have direct, long-term, beneficial impacts on the northern spotted owl, similar to alternative 2. Therefore, alternative 3 may affect but is not likely to adversely affect northern spotted owls.

*Marbled Murrelet* — The marbled murrelet has never been documented at the monument, although old-growth forest habitat, which is suitable for nesting, does exist at the monument. Alternative 3 would not result in the destruction or degradation of marbled murrelet habitat. Therefore, alternative 3 would have no impact on this species.

*California Red-Legged Frog* — Potential impacts on the California red-legged frog would be similar to those described under alternative 2. This species has not been documented at the monument and is not likely to be present due to a lack of suitable breeding habitat. However, ground disturbance associated with installation of the Dipsea Trail footbridge, culvert replacements, and construction of the lift station could result in temporary impacts on the California red-legged frog in the unlikely event that this species is present in non-breeding habitats during construction activities. Reduction of untreated stormwater runoff into Redwood Creek, stabilization of erosion hazard areas, and revegetation of portions of the Entry Plaza would result in long-term, beneficial impacts on California red-legged frog non-breeding habitat. Therefore, alternative 3 may affect but is not likely to adversely affect the California red-legged frog.

**Cumulative Impacts.** Cumulative Impacts from past, present, and reasonably foreseeable future actions would be the same as those described for alternative 1. When the impacts from alternative 3 are combined with the effects of other cumulative actions in the study area, an overall beneficial cumulative impact is expected. Alternative 3 would contribute a beneficial increment to the overall cumulative impact as a result of stormwater infrastructure improvements, which would improve habitat and water quality in Redwood Creek, and rehabilitation of riparian habitat in the Entry Plaza.

**Conclusion.** Alternative 3 would result in indirect, temporary impacts on coho salmon and steelhead trout from sedimentation and water quality degradation during construction. Construction of the Dipsea Trail footbridge over Redwood Creek, revegetation of disturbed areas, and improvements to stormwater management infrastructure would have direct and indirect, long-term, beneficial impacts on coho salmon and steelhead trout as a result of improved water quality and reduced habitat disturbances associated with foot traffic on the Dipsea Trail at the Redwood Creek crossing. Northern spotted owls could potentially be affected by noise and other disturbances associated with construction activities. Rehabilitation of riparian habitat in the Entry Plaza would have long-term, beneficial impacts on the northern spotted owl. Alternative 3 would have no impacts on marbled murrelet because no disturbances to old-growth forest habitat would occur. Alternative 3 may affect, but is not likely to adversely affect, the California red-legged frog because this species is not likely to be present in the project area. Overall, alternative 3 may affect but is not likely to adversely affect threatened or endangered species. Under alternative 3, all potential impacts would be avoided, minimized, or mitigated by the implementation of best management practices. Cumulative impacts would be beneficial. Alternative 3 would contribute a beneficial increment to the overall cumulative impact.

## CULTURAL RESOURCES

### Methodology and Assumptions

As noted in chapter 3, resources that are listed in the national register or resources that are considered eligible for the national register or that NPS staff consider archeologically sensitive are located within the area of potential effects. Cultural resources that could be affected are the national register-listed Muir Woods Historic District, the national register-listed Dipsea Trail, two national register-eligible archeological sites, and areas of archeological sensitivity east of the Annex Lot and around the Conlon Lot.

The analysis of impacts is based on a review of existing literature, data, maps, information provided by NPS staff, and professional judgment. Impacts are defined as activities that affect any character-defining features of the historic and archeological resources within the area of potential effects. Impacts could come from removing historic materials and activities that change the nature of the

resource, adding new trails, excavating in areas of archeological sensitivity, and visual impacts that detract from the natural setting of the Dipsea Trail and the Muir Woods Historic District.

### **Impacts of Alternative 1: No Action**

**Analysis.** Under alternative 1, existing management would continue, and no additional construction or ground disturbance would be required. Privately owned vehicles would continue to park along the shoulder of Muir Woods Road, but no new adverse or beneficial impacts on cultural resources would occur in these areas. The road is not part of the Muir Woods Historic District and is not a national register-eligible resource, either archeologically or above ground. Because of the location of shoulder parking, it would have no physical or visual impacts on the Muir Woods Historic District.

**Cumulative Impacts.** The implementation of the reservation system will limit the number of vehicles parking at the monument, reducing the number of vehicles that would be able to park along the shoulder of Muir Woods Road and limiting the number of visitors at the monument at any given time. A reduction in visitation would have a beneficial effect on the Muir Woods Historic District by reducing or eliminating its overuse.

The Muir Woods Road Bridge Replacement Project is located in the southern portion of the monument along Muir Woods Road. Out of visual range from the Muir Woods Historic District, the replacement of the bridge and the realignment of Muir Woods Road would have no effect on the historic district. An archeological survey of the area conducted in 2015–2016 yielded no resources on NPS land near the bridge, and the area was not identified as being archeologically sensitive (Gavette 2016). Work on the bridge is expected to be conducted in the right-of-way, and coordination among the National Park Service, the California Department of Transportation, and the California State Historic Preservation Office throughout the course of construction activities would avoid or minimize any impact on cultural resources, if discovered during construction.

As part of the Muir Woods Road Rehabilitation Project, portions of Muir Woods Road would be resurfaced, and a number of culverts would be repaired or replaced. No resources in these areas were identified in the 2015–2016 archeological survey of the area; however, monitoring during construction was recommended (Gavette 2016). The study also recommended that if any resources were discovered, construction would be stopped, and the National Park Service would follow procedures as outlined in 36 CFR 800.13 (post-review discoveries) (Gavette 2016). If no resources are discovered and if the procedures outlined in 36 CFR 800.13 are followed, this project would result in no adverse impacts on cultural resources.

The Muir Woods Water and Wastewater Service Rehabilitation Project would involve the installation of new water and sewer lines connecting the former Nursey Area to the visitor center. Associated construction would require ground disturbance and excavation. Removal and compaction would expose and disturb soils that have already been identified as potentially archeologically sensitive for subsurface resources (Gavette 2016). Similar to the Muir Woods Road Rehabilitation Project, this project would have no adverse impact on cultural resources if monitoring and the procedures outlined in 36 CFR 800.13 are followed. It is also quite possible that the soils around the existing lift station are already disturbed and are no longer archeologically sensitive. Consequently, the project would result in no adverse impact.

The Redwood Creek Trail Realignment and Dias Ridge Trail Extension Project would entail ground disturbance but would not affect the historic district. Furthermore, the project is out of visual range of the trail improvements, and its construction would not affect cultural resources at the monument.

The Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project would involve removing riprap from the banks of Redwood Creek, which would require excavating large boulders and placing large woody debris in the creek. This activity would have an adverse impact on the riprap as a historic feature, but have no adverse impacts on known archeological resources (Gavette 2016). The project may require ground disturbance along Redwood Creek but would not affect the historic district. Since creek banks are often considered archeologically sensitive, an adverse impact on subsurface archeological resources could occur from ground disturbance during removal of the riprap. However, the earth-disturbing activities would also be monitored to minimize any impacts on archeological resources. The project would also replace four bridges within the Muir Woods Historic District. The replacement bridge designs would follow the guidance of the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (NPS 1995). Consequently, the removal and subsequent replacement of the four bridges would not result in adverse impacts.

Cumulative impacts on cultural resources from these projects would include ground disturbance near areas identified as archeologically sensitive across the area of potential effects and along Redwood Creek. However, these activities would be monitored to avoid impacts to the extent possible. Replacement of the bridges inside the Muir Woods Historic District would follow the Secretary of the Interior's *Standards for the Treatment of Historic Properties* and thus have no adverse impact on the historic district (NPS 1995). Consequently, the bridge replacements would have no adverse impacts.

**Conclusion.** Under alternative 1, the potential for minimal, adverse impacts on landscape features, archeologically sensitive areas, and bridge replacement would be minimized by monitoring and documenting proposed earth-moving activities near Redwood Creek. Impacts would also be minimized by following the Secretary of the Interior's *Standards for the Treatment of Historic Properties* for the design of the bridges (NPS 1995) and 36 CFR 800.13 if archeological resources are discovered during construction. Consequently, alternative 1 would contribute minimal, adverse impacts to cumulative impacts that are otherwise expected to be largely beneficial.

## **Impacts of Alternative 2: Roadside Parking, Annex Lot Expansion, and Sustainable Access Improvements**

**Analysis.** Under alternative 2, construction activities related to the Annex Lot expansion would occur in an area that avoids archeological site CA-MRN-722H, resulting in no adverse impact on the archeological site. This expansion would not alter the visual aesthetics of the Muir Woods Historic District because the affected area would be in the same location as the existing lot. Monitoring for archeological resources would occur during the construction of infiltration trenches around each lot because the 2015–2016 archeological survey of the area indicated the potential archeological sensitivity of the soil and the need for monitoring during construction. The Annex Lot would expand by 0.02 acre, but the expansion site would be located in an area that has not been identified as archeologically sensitive. The design of the expansion of the Annex Lot would avoid site CA-MRN-722H. Soil compaction and disturbance caused by staging and stockpiling of construction equipment and materials would be avoided in areas of archeological sensitivity.

The former Nursery Area is the site of the Second Lodge of Camp Kent (about 1910–1924), while the Conlon Lot is the site of the original Camp Kent campgrounds (1898–1923) (Gavette 2016). The sensitive areas around the Conlon Lot and the former Nursery Area could be adversely affected, but planned monitoring would minimize and mitigate this impact. Demolition and revegetation activities in the former Nursery Area would be monitored in the same way as the Conlon Lot to minimize or mitigate any impacts.

Although the national register-listed Dipsea Trail would be rerouted and a new bridge would be built, this change would have no adverse impact on the trail as a whole. The national register nomination indicated that the route of the trail and its individual features have changed over its lifetime, making these proposed modifications part of the ever-changing nature of the trail. The section planned for reroute is very small, and the proposed bridge would be designed to meet the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (NPS 1995). Consequently, there would be no adverse impact on the Dipsea Trail or the Muir Woods Historic District.

The new wayfinding signs and interpretive media proposed under this alternative would follow NPS signage guidelines and would have no adverse impacts on the integrity of the Muir Woods Historic District because they would not be placed within the historic district. The new restrooms in the Entry Plaza and near the former Nursery Area would be designed in a style that is in keeping with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (NPS 1995). Consequently, the addition of the restrooms would have no adverse impact on the Muir Woods Historic District or the monument. The necessary sewer and water lines would avoid the known archeological sites and be subject to archeological monitoring during construction, resulting in no adverse impacts on any potential resources.

The creation of a new trail between the Conlon and Annex Lots would have no adverse impact because it would be constructed on fill and located in previously surveyed areas where no archeologically sensitive sites or soils were identified. The trail would not affect the Muir Woods Historic District because it would not be visible from the historic district.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 2 would result in short- and long-term, adverse impacts in areas that would be affected by management actions. Although greater than those caused by alternative 1, the adverse impacts would be minimal. Any potential impacts would be mitigated through monitoring, site avoidance, and appropriate design. When the impacts of alternative 2 are combined with the effects of cumulative actions in the project area, additional adverse impacts are expected. The overall adverse impact would be minimal.

**Conclusion.** Under alternative 2, cultural resources would experience direct, short- and long-term, minimal impacts because known archeological sites would be avoided, new structures would be designed to follow the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (NPS 1995), and areas of archeological sensitivity would be monitored. Although the impacts would be within the area of potential effects, most would occur outside the Muir Woods Historic District. No adverse impacts would occur from expanding the Annex Lot, while work at the Conlon Lot and the former Nursery Area would require monitoring to avoid or minimize impacts. New restroom facilities in the Entry Plaza and former Nursery Area would have a minimal impact because the design would follow the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (NPS 1995), and archaeological monitoring would occur during ground disturbance.

### **Impacts of Alternative 3: Nursery Parking and Sustainable Access Improvements**

**Analysis.** Under alternative 3, activities associated with the construction of the Nursery Lot, lift station, adjoining restrooms, and underground power and force main lines would avoid the identified archeological site and have no effect on the historic district because of the former Nursery Area's distance from the historic district; alternative 3 would eliminate any visual impacts.

Similar to alternative 2, construction of infiltration trenches around each lot would avoid archeologically sensitive areas and be subject to archeological monitoring. Soil compaction and disturbance caused by staging and stockpiling of construction equipment and materials would be avoided in areas of archeological sensitivity. Impacts associated with the expansion of the Conlon Lot, alterations to the Dipsea Trail, installation of additional wayfinding signs and interpretive media, and construction of a restroom in the Entry Plaza would be the same as alternative 2.

Decommissioning the Muir Woods Road pedestrian trail would beneficially change the appearance of the monument by establishing vegetation along the roadside and improving the visual approach to the Muir Woods Historic District. The proposed eastern end of the new woodland pedestrian trail connecting the Annex Lot to the Nursery Lot and the new restroom would be built in archeologically sensitive areas. However, impacts would be minimized or avoided by constructing the trail on fill and monitoring the project during construction. If avoidance measures are undertaken, the overall activities proposed in alternative 3 would result in no direct, long- or short-term, adverse impacts on cultural resources.

**Cumulative Impacts.** Impacts from past, present, and reasonably foreseeable future actions considered in the cumulative impacts analysis would be the same as those described for alternative 1. Alternative 3 would result in minimal, direct, short- and long-term impacts in some archeologically sensitive areas. However, most of these impacts would be mitigated through avoidance, monitoring, and compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (NPS 1995). When the impacts of alternative 3 are combined with the effects of cumulative actions in the project area, an overall minimal, direct impact is expected.

**Conclusion.** Under alternative 3, cultural resources would experience minimal, direct, short- and long-term impacts because known archeological sites would be avoided, structure design would follow the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (NPS 1995), and areas of archeological sensitivity would be monitored. Most of the activities proposed under alternative 3, while in the area of potential effects, would occur in locations outside the Muir Woods Historic District. There would be no adverse impacts from the construction of the Nursery Lot, lift station, adjoining restrooms, and underground power and force main lines. Work at the Conlon Lot would require monitoring to avoid or minimize impacts. The relocation or construction of new restroom facilities in the Entry Plaza would have no impact because it would follow the Secretary of the Interior's *s Standards for the Treatment of Historic Properties* (NPS 1995). Similar to alternative 2, the overall impact of alternative 3 would be minimal.

This page intentionally left blank.



## CHAPTER 5: CONSULTATION AND COORDINATION

This chapter describes the public involvement and agency consultation during the preparation of the *Muir Woods National Monument Sustainable Access Project Final Environmental Assessment*. A combination of activities, including internal scoping, has helped to guide the National Park Service in developing this environmental assessment. This chapter provides a detailed list of the various consultations initiated during the development of the document.

### PLANNING AND PUBLIC INVOLVEMENT

NEPA regulations require an “early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action” (40 CFR 1501.7). The internal scoping process for the Sustainable Access Project began on October 5, 2011. Internal and external scoping associated with this environmental assessment has been extensive and has included dozens of internal interdisciplinary team meetings and reviews.

#### Public Involvement

Public scoping for this environmental assessment began with a public notice issued on September 4, 2013, and a comment period. The document contained information on the project and was posted on the NPS Planning, Environment, and Public Comment (PEPC) website. The public comment period closed on January 11, 2014.

The National Park Service also held public and agency scoping meetings to gather input on the environmental assessment on September 18, 2013, in Mill Valley, California. The public meeting was held at the Tam Valley Elementary School from 6:30 p.m. to 8:30 p.m. The meeting began with a presentation and was followed by an open house, allowing the public to view display boards and other informational materials describing the project background and project area, the purpose of, and need for, action, and possible issues and impact topics to be analyzed in the environmental assessment. The public also had the opportunity to speak to personnel from Golden Gate National Recreation Area and from the monument to raise concerns and have their questions answered.

During the public scoping comment period, the National Park Service received 177 comments. The majority of these comments concerned potential alternatives and alternative elements. These alternatives and elements include, but are not limited to, constructing a parking lot on Panoramic Highway; implementing a reservation system to reduce congestion; enforcing restrictions on roadside parking; and making improvements to existing parking infrastructure. Commenters also provided input on issues concerning visitor experience and safety, including suggestions on how to alleviate these issues. The National Park Service continued to gather information to guide the project in several public meetings and during a gathering of community leaders convened by Congressman Jared Huffman in 2014.

A final public meeting was held on June 27, 2016, at the Tamalpais High School Student Center. At the meeting, NPS staff presented the planning background, an updated analysis of project area resources, and a range of action alternatives. The National Park Service also introduced alternative 3 as the action expected to be identified as the preferred alternative.

The *Muir Woods National Monument Sustainable Access Project Draft Environmental Assessment* was released on the PEPC website for public review and comment on November 4, 2016. The comment period lasted 30 days and closed on December 5, 2016. Copies of the draft environmental assessment were available at the Muir Woods Visitor Center and Golden Gate Dairy and were also distributed to local libraries and community centers, including the Marin County Civic Center Library, Marin City Library, Mill Valley Public Library, Sausalito Public Library, San Rafael Public Library, Muir Beach Community Center, and the Tam Valley Community Services District Office.

The California State Clearinghouse functions as the “State Single Point of Contact” for coordinating state and local review of federal environmental documents. The purpose of the process is to afford state and local participation in federal activities occurring within California. The National Park Service submitted 15 copies of the draft environmental assessment and a *Notice of Completion and Environmental Document Transmittal* form to the California State Clearinghouse for distribution to selected state and local agencies.

Eleven comments were received from organizations, individuals, and one state agency on the draft environmental assessment during the comment period. While many comments indicated support for the project, some concerns were raised regarding adverse impacts associated with the alternatives. Appendix A contains a report of the concerns raised during the comment period and the National Park Service’s responses to those concerns.

## **AGENCY CONSULTATION**

The National Park Service initiated consultation with relevant agencies during the preparation of this environmental assessment, as discussed in more detail below. Copies of correspondence between the National Park Service and these agencies are provided in appendix B.

### **Section 7 of the Endangered Species Act**

Section 7 of the Endangered Species Act requires federal agencies to consult with the US Fish and Wildlife Service regarding the potential for proposed actions to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. As described in the “Threatened and Endangered Species” section of chapter 3, federally listed species and designated critical habitat occur in the project area. As a result, the National Park Service has sought concurrence from both the US Fish and Wildlife Service and the National Marine Fisheries Service on the determination that the project may affect, but is not likely to adversely affect, federally listed species. The National Park Service received concurrence from the US Fish and Wildlife Service on March 28, 2017, and from the National Marine Fisheries Service on April 5, 2017.

### **Section 106 of the National Historic Preservation Act**

Section 106 of the National Historic Preservation Act requires federal agencies to take into account the impacts of their undertakings on historic properties. This environmental assessment evaluates impacts on cultural resources according to NPS *Management Policies 2006*. Compliance with section 106 of the National Historic Preservation Act was carried out separately but concurrently with the planning process. The National Park Service sent a letter to the California State Historic Preservation Office in September 2013 initiating consultation on the project (NPS 2016i). In a letter dated May 5, 2016, the National Park Service wrote to the California State Historic Preservation Office describing the area of potential effects and provided an archeological survey of the project area, identifying two sites and recommending monitoring for those locations as well as other areas with archeological

sensitivity (Gavette 2016). The California State Historic Preservation Office replied on July 6, 2016, acknowledging the continuation of consultation and approving the area of potential effects. The National Park Service submitted an *Assessment of Effect* to the California State Historic Preservation Office on January 10, 2017, stating that the project would have no adverse effect on the Muir Woods Historic District, the Dipsea Trail, or any other potentially eligible resource in the area of potential effects. On March 15, 2017, the National Park Service received concurrence from the California State Historic Preservation office that the Sustainable Access Project would not adversely affect cultural resources or the historic district.

This page intentionally left blank.

## ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ABA	Architectural Barriers Act
°C	degrees Celsius
CEQ	Council on Environmental Quality
cfs	cubic feet per second
CFR	Code of Federal Regulations
CNPS	California Native Plant Society
CUA	Commercial Use Authorization
μS/cm	microsiemens per centimeter
mg/L	milligrams per liter
monument	Muir Woods National Monument
national register	National Register of Historic Places
NEPA	National Environmental Policy Act
NPS	National Park Service
NTU	nephelometric turbidity units
PEPC	Planning, Environment, and Public Comment
USACE	US Army Corps of Engineers
USC	United States Code
USFWS	US Fish and Wildlife Service

This page intentionally left blank.

## REFERENCES

American Association of State Highway and Transportation Officials (AASHTO)

- 2011 *Policy on Geometric Design of Highways and Streets*. American Association of State Highway and Transportation Officials, Washington DC. 2011.

Anderson, J. K., B. Pryor, and C. Pilkington

- 2015 "Preliminary Assessment of relocating the lower portion of the Conlon/Camino del Cañon Tributary within the Golden Gate National Recreation Area, Marin County, CA. "Technical Memorandum. Northern Hydrology and Engineering. Prepared for National Park Service, Golden Gate National Recreation Area.

Anderson, J. K., B. Pryor, C. Pilkington, and C. Penny

- 2016 "Redwood Creek Pedestrian Bridge Hydrologic and Hydraulic Assessment within the Muir Woods National Monument, Marin County, California." Technical Memorandum. Northern Hydrology and Engineering. Prepared for National Park Service, Golden Gate National Recreation Area. August 1.

Armour, C. L.

- 1991 Guidance for Evaluating and Recommending Temperature Regimes to Protect Fish. US Department of the Interior, Fish and Wildlife Service.

Bay Area Stormwater Management Agencies Association (BASMAA)

- 2014 *Post-Construction Manual: Design Guidance for Stormwater Treatment and Control for Projects in Marin, Sonoma, Napa, and Solano Counties*.  
<http://www.marincounty.org/~media/files/departments/pw/mcstoppp/development/basmaa-postconstruction-manual.pdf?la=en>.

Behar, S.

- 1997 *Testing the Waters: Chemical and Physical Vital Signs of a River*. Montpelier, VT: River Watch Network. SBN-0-782-3492-3. (not seen, as cited in Wallitner 2016).

California Department of Fish and Game (CDFG)

- 2004 *Recovery Strategy for California Coho Salmon*. Report to the California Fish and Game Commission. February 2004. 594 pp.

California Department of Fish and Wildlife (CDFW)

- 2015 *Recovery Strategy for California Coho Salmon Progress Report 2004-2012*. A Report Prepared for the California Fish and Game Commission. 296 pp.

Coopridge, M.

- 2004 San Francisco Area Network Preliminary Water Quality Status Report.



## References

### Council on Environmental Quality (CEQ)

- 2016 Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. Executive Office of the President, Council on Environmental Quality, Washington DC. August 1.

### Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe

- 1979 *Classification of Wetlands and Deepwater Habitats of the United States*. US Department of the Interior, Fish and Wildlife Service, Washington, DC. Pp.131.

### Department of Defense, Department of Housing and Urban Development, General Services Administration, and US Postal Service (DoD, HUD, GSA, and USPS)

- 2015 *Architectural Barriers Act (ABA) Standards (2015)*. <https://www.access-board.gov/attachments/article/1029/ABASTandards.pdf>.

### Ellis, T.

- 2016 *Monitoring Northern Spotted Owls on Federal Lands in Marin County, California*. Prepared for the National Park Service, Inventory and Monitoring Program.

### Environmental Science Associates (ESA)

- 2014 *Redwood Creek – Channel Migration and Vulnerability Study*. Prepared for Golden Gate National Parks Conservancy. May 2014.

### Evans Mack, D., W. P. Ritchie, S. K. Nelson, E. Kuo-Harrison, P. Harrison, and T. E. Hamer

- 2003 *Methods for surveying marbled murrelets in forests: a revised protocol for land management and research*. Pacific Seabird Group. Accessed October 10, 2016. [https://www.pacificseabirdgroup.org/publications/PSG\\_TechPub2\\_MAMU\\_ISP.pdf](https://www.pacificseabirdgroup.org/publications/PSG_TechPub2_MAMU_ISP.pdf).

### Federal Emergency Management Agency (FEMA)

- 2009 “Flood Insurance Rate Map Number 06041C0465D for Marin County, California and Incorporated Areas.” May 4, 2009. Accessed May 22, 2016. <https://msc.fema.gov/portal/search>.

### Fong, D.

- 2002 “Summer 1995 Stream Habitat and Benthic Macroinvertebrate Inventory, Redwood Creek, Marin County, California.” Prepared for the National Park Service, Golden Gate National Recreation Area, Division of Natural Resource Management and Science, San Francisco, CA. (not seen, as cited in NPS 2014a).

### Forman, R. T. T., and L. E. Alexander

- 1998 “Roads and Their Major Ecological Effects.” *Annual Review of Ecology and Systematics* 29:207–231.

### Gavette, P.

- 2016 *Archeological Survey for the Muir Woods Parking Entrance Extension Planning, Muir Woods National Monument, California*.

- Georgakakos, A., P. Fleming, M. Dettinger, C. Peters-Lidard, T. C. Richmond, K. Reckhow, K. White, and D. Yates  
 2014 “Water Resources.” In *Climate Change Impacts in the United States: The Third National Climate Assessment*, edited by J. M. Melillo, Terese (T. C.) Richmond, and G. W. Yohe. U.S. Global Change Research Program 69-112.  
<http://nca2014.globalchange.gov/report/sectors/water>.
- Gerow, K., N. C. Kline, D. E. Swann, and M. Pokorny  
 2010 “Estimating Annual Vertebrate Mortality on Roads at Saguaro National Park, Arizona.” *Human-Wildlife Interactions* 4:283–292.
- Kelly, E. G., E. D. Forsman, and R. G. Anthony  
 2003 “Are Barred Owls Displacing Spotted Owls?” *The Condor* 105:45–53.
- Kimball, L. C., and G. M. Kondolf  
 2002 Analysis of Channel Geomorphology and Habitat Forming Processes for Feasibility Assessment of Rip-rap Removal, Muir Woods National Monument, Mill Valley, California. Prepared for the National Park Service. May 2002.
- Madej, M. A.  
 2010 “Analysis of trends in climate, streamflow, and stream temperature in north coastal California.” Bull Creek near Weott USGS Humboldt. 1961:72–8.
- Marin Transit  
 2015 “2015 Muir Woods Shuttle Evaluation Report.”  
 2016 Muir Woods Shuttle Schedule. Accessed May 16, 2016.  
<http://www.marintransit.org/routes/66.html>.
- McBride, J., and D. Jacobs  
 1978 *The History of the Vegetation at Muir Woods National Monument*. Prepared for the National Park Service, San Francisco, California.
- National Marine Fisheries Service (NMFS)  
 2016 *5-Year Review: Summary and Evaluation of Central California Coho Salmon*. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, West Coast Region. April 2016. 48 pp.
- National Parks Conservation Association (NPCA)  
 2009 *Muir Woods National Monument State of the Parks Natural Resources Assessment*. Report Prepared for the National Parks Conservation Association Center for State of the Parks.  
 2011 *Muir Woods National Monument: A Resource Assessment. State of the Parks*. 36 pp.  
<https://www.nps.gov/muwo/learn/management/upload/State-of-the-Parks-MUWO-by-NPCA.pdf>.

National Park Service, US Department of the Interior (NPS)

- n.d. "Plan your Visit" Webpage. Accessed May 16, 2016.  
<https://www.nps.gov/muwo/planyourvisit/upload/Parking-v-2-2.pdf>.
- 1995 The Secretary of the Interior's *Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings*. Prepared by Kay D. Weeks and Anne E. Gimmer for the US Department of the Interior, National Park Service, Cultural Resources Stewardships and Partnerships, Heritage Preservation Services, Washington DC.
- 1999 *Fort Baker Plan Final Environmental Impact Statement*. Golden Gate National Recreation, Area Marin County, California. October 1999.
- 2000 Director's Order 47: *Soundscape Preservation and Noise Management*. NPS Office of Policy.
- 2001 *Director's Order 12 Handbook*.  
<http://planning.nps.gov/document/do12handbook1.pdf>.
- 2002 Director's Order 77-1: *Wetland Protection*. NPS Office of Policy.
- 2003 Director's Order 77-2: *Floodplain Management*. NPS Office of Policy.
- 2005 *Fire Management Plan Final Environmental Impact Statement*. Golden Gate National Recreation Area. November 2005.
- 2006 *Management Policies 2006*. Accessed October 2015.  
<http://www.nps.gov/policy/mp2006.pdf>.
- 2009 *General Management Planning Dynamic Sourcebook*. Version 2.2, December 2009. NPS-DOI. Accessed May 23, 2016.  
[http://parkplanning.nps.gov/files/GMPSourcebook/GMPSourcebook\\_Dec2009ver2.2.pdf](http://parkplanning.nps.gov/files/GMPSourcebook/GMPSourcebook_Dec2009ver2.2.pdf).
- 2011a Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-Making*. Washington, DC.
- 2011b Photos from the Muir Woods Transportation and Access Plan Kick-Off Meeting.
- 2011c *Redwood Creek Watershed Assessment*. Prepared by Stillwater Sciences and Horizon Water and Environment, LLC. August 2011.  
<http://www.nps.gov/goga/learn/management/redwood-creek-watershed-assessment.htm>.
- 2012a *Climate Change Action Plan 2012–2014*. National Park Service. November 2012.  
[https://www.nature.nps.gov/climatechange/docs/NPS\\_CCActionPlan.pdf](https://www.nature.nps.gov/climatechange/docs/NPS_CCActionPlan.pdf).
- 2012b "Technical Memorandum #4: Visitor Experience." Muir Woods National Monument Transportation and Access Planning. June 2012.

- 2012c “Technical Memorandum #1: Muir Woods Transportation and Access Planning.” Muir Woods National Monument Transportation and Access Planning.
- 2012d “Technical Memorandum #3: Transportation.” Muir Woods National Monument Transportation and Access Planning. June 2012.
- 2013a “Vegetation Resource Surveys in Muir Woods National Monument Parking Alternatives Project. Results of Vegetation Mapping, Floristic Surveys, and Focused Rare Plant Species Surveys.”
- 2013b Personal Communication between Robert Steers and Steven Culver, National Park Service.
- 2014a Golden Gate National Recreation Area and Muir Woods National Monument Final General Management Plan / Environmental Impact Statement.  
<https://parkplanning.nps.gov/document.cfm?parkID=303&projectID=15075&documentID=58777>.
- 2014b *User Capacity Ranges to Support Transportation and Visitor Experience Planning, Muir Woods National Monument.*
- 2015a *National Park Service NEPA Handbook.*  
<http://www.nps.gov/applications/npspolicy/DOrders.cfm>.
- 2015b *Muir Woods National Monument Reservation System Environmental Assessment.* Accessed October 2015.  
<http://parkplanning.nps.gov/documentsList.cfm?projectID=48272>.
- 2015c Finding of No Significant Impact, Muir Woods National Monument Reservation System. Accessed September 2016.  
<https://parkplanning.nps.gov/document.cfm?parkID=303&projectID=48272&documentID=70152>.
- 2015d Memorandum of Understanding between National Park Service and County of Marin, executed December 23, 2015.
- 2015e *Record of Decision for the Golden Gate National Recreation Area and Muir Woods National Monument Final General Management Plan / Environmental Impact Statement.* January.
- 2015f County of Marin / National Park Service Muir Woods Memorandum of Understanding Update. June 14, 2016. Accessed May 9, 2017.  
[https://www.nps.gov/goga/learn/management/upload/BOS-Muir-Woods-Jun-14-2016\\_merge-Co-ver1-1.pdf](https://www.nps.gov/goga/learn/management/upload/BOS-Muir-Woods-Jun-14-2016_merge-Co-ver1-1.pdf)
- 2015g *Redwood Creek Trail Realignment and Dias Ridge Trail Extension Project Environmental Assessment / Initial Study.* Muir Woods National Monument. November.

## References

- 2016a Personal communication between Lee Terzis, National Park Service, Denver Service Center, and Derrick Rosenbach, Louis Berger, concerning dismissal of Indian Trust Resources and Indian Sacred Sites. October 19.
- 2016b Personal communication between Brian Aviles, Golden Gate National Recreation Area, and Derrick Rosenbach, Louis Berger, on the placement of restrooms at Muir Woods National Monument. June 28.
- 2016c “Muir Woods Hiking Trails.” Accessed May 16, 2016.  
<https://www.nps.gov/muwo/planyourvisit/hiking-trails.htm>.
- 2016d Personal communication between Darren Brown and Steve Culver on vehicle traffic at Muir Woods National Monument. September 21.
- 2016e 2016–2017 Commercial Carrier CUA Application Package. Accessed September 28, 2016.
- 2016f “Vascular Plants at Muir Woods National Monument.” NPSpecies Report. Accessed June 6, 2016. <https://irma.nps.gov/NPSpecies/Search/SpeciesList>.
- 2016g *Freshwater Quality Monitoring in the San Francisco Bay Area Network 2011-2012 Biennial Report*. Natural Resource technical Report NPS/SFAN/MRTR—2013/801. October 2013. [http://www.sfnps.org/download\\_product/4478/0](http://www.sfnps.org/download_product/4478/0).
- 2016h *Biological Assessment for the Sustainable Access Project at Muir Woods National Monument*.
- 2016i Request for concurrence from the California State Historic Preservation Officer regarding the adequacy of the Area of Potential Effects for Muir Woods National Monument.
- 2017a *Water / Wastewater Service Rehabilitation Draft Environmental Assessment*. Muir Woods National Monument. March.
- 2017b *Salmon Habitat Enhancement and Bridge Replacement Project Draft Environmental Assessment*. Muir Woods National Monument. Prepared by Horizon Water and Environment, LLC. April.

### National Park Service and Marin County

- 2007 Wetland and Creek Restoration at Big Lagoon, Muir Beach, Marin County, Final Environmental Impact Statement/Environmental Impact Report. Report SCHB #2004042143.

### Nature Conservancy, The

- 2009 *Climate Wizard for California, Change in Annual Temperature by the 2080s*.  
<http://www.climatewizard.org/>.

Nearing, M. A., F. F. Pruski, and M. R. O'Neal

- 2004 "Expected Climate Change Impacts on Soil Erosion Rates: A review." *Journal of Soil and Water Conservation* 59(1):43–50. Accessed on May 27, 2016. [http://animalagclimatechange.org/wp-content/uploads/Expected\\_climate\\_change\\_impacts\\_on\\_soil\\_erosion1.pdf](http://animalagclimatechange.org/wp-content/uploads/Expected_climate_change_impacts_on_soil_erosion1.pdf).

Roche, L., L. Kromschroeder, E. Atwill, R. Dahlgren, and K. Tate

- 2013 *Water Quality Conditions Associated with Cattle Grazing and Recreation on National Forest Lands*. PLoS ONE 8(6): E68127. DOI:10.1371/journal.pone.0068127. (not seen, as cited in Wallitner 2016).

Ryan, A.

- 2016 Delineation of Wetlands and "other Waters" at Redwood Creek and Vicinity, Muir Woods National Monument, Golden Gate National Recreation Area. National Park Service, Marin County, CA. February 2016.

San Francisco Bay Region Water Quality Control Board (San Francisco RWQCB)

- 2013 *San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan)*. June 29, 2013. [http://www.waterboards.ca.gov/sanfranciscobay/water\\_issues/programs/planningtmdls/basinplan/web/docs/BP\\_all\\_chapters.pdf](http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/planningtmdls/basinplan/web/docs/BP_all_chapters.pdf).

Trombulak, S. C., and C. A. Frissell

- 2000 "Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities." *Conservation Biology* 14:18–30.

US Department of Agriculture, Natural Resources Conservation Service (USDA, NRCS)

- 2016 "Web Soil Survey." Accessed May, 26, 2016. <http://websoilsurvey.nrcs.usda.gov/>

US Department of Agriculture, Soil Conservation Service, (USDA, SCS)

- 1985 *Soil Survey of Marin County, California*. Accessed May, 26, 2016. [http://www.nrcs.usda.gov/Internet/FSE\\_MANUSCRIPTS/california/marinCA1985/marinCA1985.pdf](http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/marinCA1985/marinCA1985.pdf).

US Environmental Protection Agency (USEPA)

- 1998 Environmental Justice Guidance.
- 2000 Ambient Water Quality Criteria Recommendations Information Supporting the Development of State and Tribal Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion III. EPA 822-B-00-016. <http://www2.epa.gov/nutrient-policy-data/ecoregional-nutrient-criteria-documents-rivers-and-streams>.

## References

- 2008 Green Parking Lot Resource Guide.  
<https://nepis.epa.gov/Exe/ZyNET.exe/P100D97A.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C06thru10%5CTxt%5C00000031%5CP100D97A.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL>.
- US Fish and Wildlife Service (USFWS)
- 1997 Recovery Plan for the Threatened Marbled Murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. Portland, OR: US Fish and Wildlife Service.
  - 2009 “National Wetlands Inventory” Website. Washington, D.C: US. Department of the Interior, Fish and Wildlife Service. Accessed May 27, 2016.  
<http://www.fws.gov/wetlands/>.
  - 2011 Revised Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*). Portland, OR: US Fish and Wildlife Service.
  - 2012 “Report on Marbled Murrelet Recovery Implementation Team Meeting and Stakeholder Workshop.”
  - 2016 “Species Profile for steelhead (*Oncorhynchus* (=salmo) *mykiss*),” Environmental Conservation Online System (ECOS). Accessed May 2016.  
[http://ecos.fws.gov/tess\\_public/profile/speciesProfile.action?spcode=E08D](http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=E08D).
- US Geological Survey (USGS)
- 2016 “National Water Information System Data for USGS Station 11460151, Redwood Creek.” Accessed May 24, 2016.  
[http://waterdata.usgs.gov/nwis/inventory/?site\\_no=11460151&agency\\_cd=USGS](http://waterdata.usgs.gov/nwis/inventory/?site_no=11460151&agency_cd=USGS).
- Wallitner, K.
- 2016 “Freshwater Quality Monitoring in the San Francisco Bay Area: 2013-2014 Biennial Report.” Natural Resource Report NPS/SFAN/NRR—2016/1188. National Park Service, Fort Collins, CO.
- Walsh, J., D. Wuebbles, K. Hayhoe, J. Kossin, K. Kunkel, G. Stephens, P. Thorne, R. Vose, M. Wehner, J. Willis, D. Anderson, S. Doney, R. Feely, P. Hennon, V. Kharin, T. Knutson, F. Landerer, T. Lenton, J. Kennedy, and R. Somerville
- 2014 “Our Changing Climate.” In *Climate Change Impacts in the United States: The Third National Climate Assessment*, edited by J. M. Melillo, Terese (T. C.) Richmond, and G. W. Yohe. U.S. Global Change Research Program 19-67. Accessed May 27, 2016.  
<http://nca2014.globalchange.gov/report/our-changing-climate/introduction>.

## LIST OF PREPARERS

Name	Title
<b>National Park Service</b>	
Patrick Shea	Project Manager, Denver Service Center
Patricia Sacks	Landscape Architect, Denver Service Center
Steven Culver	Natural Resource Specialist, Denver Service Center
Lee Terzis	Cultural Resource Specialist, Denver Service Center
Brian Aviles	Chief of Planning, Golden Gate National Recreation Area
Darren Brown	Transportation Planner, Golden Gate National Recreation Area
Mia Monroe	Liaison to Marin Communities, Golden Gate National Recreation Area
Dianne Croal	Pacific West Region Lead for Alternative Transportation
Steve Haller	Acting Chief of Cultural Resources
<b>Louis Berger</b>	
Derrick W. Rosenbach	Environmental Scientist
Cheryl Chapman	Vice President
Lori Fox	Senior Planner
Mark Berger	Principal Transportation Planner
Erin Hagan	Environmental Scientist
Joseph Dalrymple	Biologist/Environmental Scientist
Steven Bedford	Principal Architectural Historian
Rudi Byron	Senior Environmental Planner



This page intentionally left blank.

**APPENDIX A**

**RESPONSES TO PUBLIC COMMENTS ON  
THE DRAFT ENVIRONMENTAL ASSESSMENT**

This page intentionally left blank.



**Muir Woods National Monument**

**Sustainable Access Project**

**Draft Environmental Assessment**

***Concern-Response Report***

**March 2017**

# CONTENTS

INTRODUCTION.....	1
DEFINITION OF TERMS .....	1
COMMENT ANALYSIS METHODOLOGY .....	1
CONTENT ANALYSIS REPORT.....	2
CONCERN REPORT.....	4

## INTRODUCTION

The National Park Service (NPS) prepared the Muir Woods National Monument Sustainable Access Project Draft Environmental Assessment to analyze the potential effects of alternatives related to improving visitor access and arrival facilities at Muir Woods National Monument (monument). This draft environmental assessment describes and analyzes three alternatives: two action alternatives and one no-action alternative. The purpose of the proposed action, which has been identified as alternative 3, is to improve visitor experience and safety by providing appropriate infrastructure, promoting the restoration of natural resources and processes, and preserving cultural resources. The proposed action would allow the monument to address deferred maintenance, improve the design and placement of parking areas and visitor amenities, and to resolve long-standing problems with traffic congestion that detracts from visitor experience, creates the potential for safety concerns, and negatively affects stormwater management and water quality in the Redwood Creek Watershed.

On November 4, 2016, the Muir Woods National Monument Sustainable Access Project Draft Environmental Assessment was released for public review. A 30-day comment period closed on December 5, 2016. The draft environmental assessment was circulated to local, state, and federal agencies, interested organizations, and individuals to allow review and comment on the document. Publication of the draft environmental assessment on the NPS Planning, Environment and Public Comment (PEPC) website (<http://parkplanning.nps.gov/>) marked the beginning of the public comment period, during which comments were accepted.

## DEFINITION OF TERMS

**Correspondence:** A correspondence is the entire document received from a commenter and includes letters; written comment forms; comments entered directly into the PEPC database; and any other written comments provided either at the public meetings, by postal mail, or in person at the park.

**Comment:** A comment is a portion of text within a correspondence that addresses a single subject such as water quality or mitigation measures. The comment could also question the accuracy of the information provided in the draft environmental assessment, question the adequacy of the analysis, or present reasonable alternatives other than those presented in the document.

**Code:** A code is a grouping centered on a common subject, such as alternatives eliminated from further analysis. The codes were developed during the scoping process and are used to track major subjects. In cases where no comments are received on an issue, the code is not identified or discussed in this report.

**Concern Statements:** Concern statements summarize the issues identified by each code. Each code was characterized by concern statements to provide a better focus on the content of comments. Some codes require multiple concern statements, such as those discussing different projects associated with cumulative impacts.

## COMMENT ANALYSIS METHODOLOGY

Comment analysis is a process used to compile and correlate similar comments into a usable format for decision makers and the project interdisciplinary planning team. Comment analysis assists the team in organizing, clarifying, and addressing information pursuant to National Environmental Policy Act

regulations. It also aids in identifying the topics and issues to be evaluated and considered throughout the planning process.

The process includes five main components:

- developing a coding structure
- employing a comment database for comment management
- reading and coding of comments
- interpreting and analyzing the comments to identify issues and themes
- preparing a comment summary

A coding structure was developed to help sort comments into logical groups by topic and issue. The National Park Service derived the coding structure from an analysis of the range of topics discussed during internal scoping, past planning documents, and the comments themselves. The coding structure was designed to capture all the content of all comments rather than to restrict or exclude any ideas.

The NPS PEPC database was used to manage the comments. The database stores the full text of all correspondence and allows each comment to be coded by topic and issue. The database tallies the total number of pieces of correspondence and comments received, can sort and report comments by a particular topic or issue, and provides demographic information on the sources of each comment.

Analysis of the public comments involved assigning codes to statements made in letters, e-mail messages, and comment forms submitted via the PEPC database. All comments were read and analyzed, including those of a technical nature, opinions, suggestions, and comments of a personal or philosophical nature.

Under each code, all comments were grouped by similar themes, and those groups were summarized with a concern statement. Following each concern statement are one or more “representative quotes,” which are comments taken from the correspondence to illustrate the issue, concern, or idea expressed by the comments grouped under that concern statement.

Although the analysis process attempts to capture the full range of public concerns, this concern report should be used with caution. Comments from people who chose to respond do not necessarily represent the sentiments of the entire public.

## **CONTENT ANALYSIS REPORT**

The following tables were produced by the PEPC database and provide information about the numbers and types of comments received, organized by code and by various demographics. The first table is a summary of the number of comments received under each code. Data on the number of correspondences received by correspondence type, organization type, state, and country are then presented in subsequent tables.

Comment Distribution by Code			
Code	Description	Comments	Percentage
MT1000	Miscellaneous Topics: General Comments	7	16%
AL 1410	Alternative Elements: Improved Pedestrian Trail Connections (Non-Substantive)	4	9%
GA1050	Impact Analysis: Cumulative Impacts	3	7%
AL4000	Alternatives: New Alternatives Or Elements	2	5%
AE1500	Affected Environment: Transportation	2	5%
AL1750	Alternative Elements: Additional Visitor Amenities	2	5%
PN8050	Purpose And Need: Objectives In Taking Action (Non-Substantive)	2	5%
WQ4000	Water Resources: Impact Of Proposal And Alternatives	2	5%
AL5700	Alternatives: Support Alternative 3	2	5%
AL5900	Alternatives: Mitigation Measures	2	5%
GA1000	Impact Analysis: Impact Analyses	1	2%
AL1400	Alternative Elements: Improved Pedestrian Trail Connections	1	2%
VES4000	Visitor Experience and Safety: Impact of the Proposal and Alternatives	1	2%
GA1060	Impact Analysis: Cumulative Impacts (Non-Substantive)	1	2%
ON1000	Other NEPA Issues: General Comments	1	2%
CC1000	Consultation and Coordination: General Comments	1	2%
PN9000	Purpose And Need: Issues And Impact Topics Selected For Analyses	1	2%
AL5800	Alternatives: Oppose Alternative 3	1	2%
AE22010	Affected Environment: Visitor Experience and Safety (Non-Substantive)	1	2%
PN1000	Purpose And Need: Planning Process And Policy	1	2%
MOU1000	Memorandum of Understanding	1	2%
AE25000	Affected Environment: Water Resources	1	2%
MOU1060	Memorandum of Understanding (Non-Substantive)	1	2%
AL2000	Alternatives: Alternatives Eliminated	1	2%
TR4000	Transportation: Impact Of Proposal And Alternatives	1	2%
PN8000	Purpose And Need: Objectives In Taking Action	1	2%



Correspondence Distribution by Correspondence Type	
Correspondence Type	Correspondences
Web Form	10
Letter	1

Correspondence Distribution by Organization Type	
Organization Type	Correspondences
State Government	1
Unaffiliated Individual	10

Correspondence Distribution by State	
State	Correspondences
CA	9
NV	1
MD	1

Correspondence Distribution by Country	
Country	Correspondences
USA	11

## CONCERN REPORT

The following text summarizes the comments received during the 30-day comment period and is organized by code into concern statements, responses, and representative quotes. All page numbers contained herein refer to the Sustainable Access Project Draft Environmental Assessment.

### ***AE1500 - Affected Environment: Transportation***

**CONCERN STATEMENT:** (Concern ID: 59290) One commenter stated that the affected environment and impact analysis should discuss congestion and safety issues in nearby neighborhoods as a result of visitation to the monument, particularly limited access by emergency vehicles.

**RESPONSE:** The National Park Service is in the process of implementing a reservation system to manage motorized vehicle access to the monument. The reservation system will support a phased elimination of shoulder parking along Muir Woods Road and reduce peak-hour trips throughout the year, and by as much as 45% during peak season. It is anticipated that the phased elimination of shoulder parking and reduced peak-hour trips will improve access for emergency vehicles and residents in the project area and in local communities by providing a wide and clear right-of-way for navigation along Muir Woods Road.

### ***Representative Quote(s):***

**Corr. ID:** 8

**Organization:** Marin Conservation League

**Comment ID:** 542499

**Organization Type:** Unaffiliated Individual

**Representative Quote:** The description of the area under various topics is informative and generally adequate. As mentioned above, however, the EA is self-serving in the areas of Visitor Safety and Experience, and Transportation. Essentially no mention is made of existing conditions of congestion, safety, or limits to emergency access as they currently affect nearby communities or vehicles that are not visiting the monument. This deficiency should be corrected, and the scope of analysis widened to include the transportation and emergency access needs of the local community

**CONCERN STATEMENT:** (Concern ID: 59291) One commenter requested the deletion of a statement regarding bicycle-vehicle conflicts from the affected environment because the commenter believes it places more emphasis on congestion caused by bicycles than by motor vehicles.

**RESPONSE:** The National Park Service concurs that the large volume of motor vehicles contributes to congestion. The Sustainable Access Project Draft Environmental Assessment notes this issue on page 36, "Parking demand regularly exceeds supply because only 232 privately owned vehicle spaces are available between the Muir Woods Road Bridge and the monument entrance, resulting in congestion." The "Transportation" section of the "Affected Environment" chapter aims to describe existing traffic conditions at the monument, including those conditions that result from bicycle use, to provide a baseline for predicting changes that could occur under any of the alternatives under consideration. For this reason, the statement regarding bicycles is accurate and will be retained in the environmental assessment.

**Representative Quote(s):**

**Corr. ID:** 11

**Organization:** California State Transportation Agency

**Comment ID:** 542849

**Organization Type:** State Government

**Representative Quote:** Please delete the following sentence on page 36, "Bicycles can create congestion on the roadways because of their lower speed and bicycle-vehicle conflicts on the narrow travel ways and winding roadways that connect the monument to the rest of Marin County." The larger volume of motor vehicles also creates congestion, especially with parking maneuvers, but this was not called out as directly as bicycles in the above referenced sentence.

### ***AE25000 - Affected Environment: Water Resources***

**CONCERN STATEMENT:** (Concern ID: 59292) One commenter stated that a discussion in the environmental assessment of Conlon Creek's history and connectivity to Redwood Creek would be helpful.

**REPOSE:** A brief description of the connectivity of these two waterbodies is discussed on page 43 of the Sustainable Access Project Draft Environmental Assessment. This section states: "Conlon Creek currently flows parallel along the east side of Muir Woods Road; however, historically, it flowed along a more direct southwesterly route to Redwood Creek with a confluence that would have been located on the western side of Muir Woods Road." The "Water Resources and Hydrologic Processes" section of the "Affected Environment" chapter represents existing conditions, which have been influenced by the creek's history.

***Representative Quote(s):***

**Corr. ID:** 8

**Organization:** Marin Conservation League

**Comment ID:** 544429

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Under the topic of Water Resources and Hydrologic Processes, it would be helpful to provide a brief description of the Conlon Creek watershed, history modifications, and its connectivity to Redwood Creek, as detailed in a memo from Phil Williams.

***AL1400 - Alternative Elements: Improved Pedestrian Trail Connections***

**CONCERN STATEMENT:** (Concern ID: 59293) One commenter questioned why design details for the Dipsea Trail footbridge were absent from the environmental assessment and requested that more information be provided in the alternative descriptions.

**RESPONSE:** The range of alternatives presented in the Sustainable Access Project Draft Environmental Assessment constitutes different conceptual approaches to resolving the purpose of, and need for, action. The National Park Service recognizes the need to protect water quality in the project area by eliminating instream foot traffic in Redwood Creek, and the construction of a Dipsea Trail footbridge would be a mode by which the agency can meet that need; however, the exact design that would accomplish this goal could be implemented in a number of different ways. A report containing potential designs for the footbridge has been uploaded to the PEPC website for the Sustainable Access Project. As the footbridge design is further developed, consultation with the appropriate agencies, such as the US Fish and Wildlife Service and National Marine Fisheries Service, would continue to ensure that the footbridge design minimizes any potential impacts.

***Representative Quote(s):***

**Corr. ID:** 8

**Organization:** Marin Conservation League

**Comment ID:** 542496

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Because both "build" Alternatives plan to replace the wooden plank that now serves as the Dipsea bridge with a permanent footbridge, we question the absence of further information about the bridge. Why does the EA contain no design details for the replacement bridge, which presumably will span the creek at least above bank-full stage? (A search of the document reveals more information on the Dipsea bridge on page 75, in the environmental consequences of Alternative 2, under the topic of Water Resources and Hydrologic Processes. Please bring this information forward into the description of alternatives so that it is more obvious!)

***AL2000 - Alternatives: Alternatives Eliminated***

**CONCERN STATEMENT:** (Concern ID: 59294) One commenter suggested that the eliminated "Construct a Parking Lot on Panoramic Highway" alternative could be designed to minimize impacts on the viewshed and should be considered in the range of alternatives.

**RESPONSE:** The National Park Service eliminated this alternative from further consideration in the Record of Decision for the Golden Gate National Recreation Area and Muir Woods National Monument General Management Plan / Environmental Impact Statement because of public concerns and agency analysis. As stated on page 24 of the Sustainable Access Project Draft Environmental Assessment, the reasons for elimination extend beyond viewshed impacts and include traffic circulation for the sites assessed, potential for vehicular and pedestrian safety problems, and a general lack of public support.

***Representative Quote(s):***

**Corr. ID:** 1

**Organization:** Not Specified

**Comment ID:** 542462

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Since shuttles are operated from Sausalito, it is not clear why similar shuttles could not operate from parking lots on Panoramic Hwy. I reject the argument against these lots that says they interfere with views. Lots could be designed to minimize this interference. Provision should be made for increased parking closer to the Monument, as on Panoramic Hwy.

***AL4000 - Alternatives: New Alternatives or Elements***

**CONCERN STATEMENT:** (Concern ID: 59295) Commenters stated that the alternatives in the environmental assessment should include a discussion of bicycle parking. Furthermore, commenters suggested the alternatives should consider parking spaces for recreational vehicles and an overall reduction in available parking spaces.

**RESPONSE:** As noted on page 36 of the Sustainable Access Project Draft Environmental Assessment, “bicycle racks are located near the monument entrance, approximately 80 feet west of the ABA-compliant parking in the Entry Plaza.” These racks would remain available, but could be relocated.

Though the National Park Service understands some visitors would prefer to arrive by recreational vehicle, the Muir Woods National Monument Reservation System Finding of No Significant Impact approved 232 parking spaces for personal occupancy vehicles in addition to commercial buses and shuttle spaces.

***Representative Quote(s):***

**Corr. ID:** 1

**Organization:** Not Specified

**Comment ID:** 542403

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Also, there will be some RV's, which require larger spaces. Some lot areas should be designated for RV's.

**Corr. ID:** 1

**Organization:** Not Specified

**Comment ID:** 542402

**Organization Type:** Unaffiliated Individual

**Representative Quote:** I did not find any discussion of how bicycle parking will be handled.

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542841

**Organization Type:** Unaffiliated Individual

**Representative Quote:** NPS must consider alternatives that would reduce the number of parking spots inside the Monument. For example, NPS should consider an alternative that would eliminate parking on the road but not create a new parking lot or expand existing lots. Such an alternative is consistent with the purpose and need of the proposed action, and could even accommodate increasing visitation/use through an increase in the number of parking spots for buses within the Muir Woods parking lots.

### ***AL5800 - Alternatives: Oppose Alternative 3***

**CONCERN STATEMENT:** (Concern ID: 59296) One commenter raised concern regarding alternative 3 and its potential to increase surface runoff during storm events as a result of constructing a parking lot in the former Nursery Area. The commenter also stated the alternative would prohibit restoration of Conlon Creek to its historic geomorphic streambed and would alter both under-ground and above-ground hydrology.

**RESPONSE:** As noted in the Sustainable Access Project Draft Environmental Assessment, infiltration trenches would be used to treat the runoff from the Entry Plaza and all parking lots. These trenches would greatly reduce the volume of runoff and would promote groundwater recharge because they would allow a significant amount of rainwater to infiltrate. Incorporating these and other best management practices into the design of the former Nursery Area parking lot would ensure that discharge from this infrastructure would meet the applicable water quality standards, such as those found in the Bay Area Stormwater Management Agencies Association Post-Construction Manual, and would not require additional treatment.

Realignment of Conlon Creek was considered during the early development of the alternatives. It was determined, however, that realignment would actually make the tributary less stable and less ecologically functional, add costs and adverse resource impacts, as well as reduce the functionality and useful life of bridge structures. The current alignment is stable, with no head cutting or grade control structures required. Realignment of the creek would require grade control structures to ensure channel stability, particularly on the immediate approach to Redwood Creek. Because of severe down-cutting of Redwood Creek, the channel elevation is substantially lower than the historic channel elevations. Therefore, realigning Conlon Creek would not emulate historic streambed conditions because it would require a series of grade control structures to prevent instability and head-cutting similar to what is occurring approximately 1,640 feet upstream between the Annex Lot and Main Lot. The addition of grade control structures to the tributary and culvert at the road crossing would actually worsen the ecologic connectivity and functionality between Redwood Creek and the tributary compared to current conditions.

Realignment would require the construction of over 300 feet of new channel and a new structure under Muir Woods Road. In addition, the alignment would bring the tributary through two more structures than it currently does (i.e. the new structure under Muir Woods Road and the existing Muir Woods Road concrete bridge), creating potential sediment-loading and reductions in hydrologic capacity.

***Representative Quote(s):***

**Corr. ID:** 10 Organization: Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542843

**Organization Type:** Unaffiliated Individual

**Representative Quote:** MTTF does not support the creation of an additional parking lot on the old Nursery Area. Construction of this lot would cause additional detrimental impacts on Redwood Creek and would foreclose the restoration of Conlon Creek to its original channel. For example, parking in this area could further damage the underground hydrology and be a contributing source of toxic contamination of Redwood Creek from surface runoff during storm events, which may increase in number and severity with climate change. Moreover, SAP alternative 3 would prohibit any restoration of the historic Conlon Creek geomorphic streambed, below the Original Kent Campgrounds, to its original course through the Nursery area. The alternative would cover the historic streambed with a parking lot. See Historic Resource Study for Muir Woods National Monument, Golden Gate National Recreation Area, page 128

***AL5900 - Alternatives: Mitigation Measures***

**CONCERN STATEMENT:** (Concern ID: 59297) Commenters stated that mitigation measures related to the implementation of the Sustainable Access Project should be coordinated with other projects to reduce overall impacts on the environment and local residents, such as discharge of sediment, removal of buckeye trees, invasive species dispersal, and posting of construction signage. One commenter also suggested that the project respect and follow the recommendations for salmon recovery found in the 2012 Final Recovery Plan for Central California Coast Coho Salmon Evolutionary Significant Unit and the 2002 Watershed Assessment and Erosion Prevention Planning Project for the Redwood Creek Watershed.

**RESPONSE:** The National Park Service would implement mitigation measures and best management practices as an integral component of the proposed action. These mitigation measures, presented on page 20 of the Sustainable Access Project Draft Environmental Assessment, would be coordinated with the other projects described in the environmental assessment and any projects that may arise in the years following implementation of the Sustainable Access Project.

Implementing all of the recommended actions under the 2012 Final Recovery Plan for Central California Coast Coho Salmon Evolutionary Significant Unit and the 2002 Watershed Assessment and Erosion Prevention Planning Project for the Redwood Creek Watershed is outside the scope of the Sustainable Access Project. However, many elements of the proposed action are consistent with the actions recommended in both documents, including removing a portion of the Entry Plaza and planting up to 0.4 acres of native vegetation to promote stream-side shade, improving water quality conditions by adding infiltration trenches to treat stormwater runoff from parking areas, replacing undersized or damaged culverts, removing streamside parking to help reduce sediment delivery, and replacing the wooden plank at the Dipsea Trail crossing at Redwood Creek with a new footbridge to protect existing riparian areas.

***Representative Quote(s):***

**Corr. ID:** 8 Organization: Marin Conservation League

**Comment ID:** 542497

**Organization Type:** Unaffiliated Individual

**Representative Quote:** The list of standard mitigation measures (best management practices) in the EA is comprehensive. We wish to emphasize the importance of protecting existing native trees like Buckeye, which forms a notable stand at Muir Woods, from disturbance in constructing the new woodland trail, and

the importance of monitoring that trail following construction for invasive species. This includes "invasion" of annual grasses and forbs. New trails are convenient avenues for invasion of non-native plants (weeds) into disturbed soil.

**Corr. ID:** 8

**Organization:** Marin Conservation League

**Comment ID:** 542498

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Among the BMPs for Visitor Experience, Safety, and Transportation, we suggest that you notify local residents by posting signs to warn of upcoming construction activities, whether for a period of time (weeks, months?) for episodic equipment activity.

**Corr. ID:** 10 Organization: Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542837

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Project priorities and sequencing should respect and follow the recommendations for salmon recovery from the National Marine Fisheries Service's 2012 Central Coast Coho Recovery Plan. That plan incorporates the 2002 erosion study by Pacific Watershed Associates (PWA) to inform prioritization of treatments necessary to control discharges of sediment. These treatments have yet to be properly implemented. NPS and the County Supervisors also agreed in public meetings to provide an updated PWA report, and to consider the report's findings in project design. This update was scheduled to be presented to the public by June, 2016, with the objective of establishing environmental priorities. However the updated PWA report has not been provided to the public, and this makes it impossible to measure the value of proposed projects against the benchmarks that NPS has agreed to be important in project design.

### ***CC1000 - Consultation and Coordination: General Comments***

**CONCERN STATEMENT:** (Concern ID: 59298) One commenter raised concern about the level of documentation and outreach conducted by the National Park Service.

**RESPONSE:** Public outreach for the Sustainable Access Project began with a public notice issued on September 4, 2013. The public notice contained information about the project and was posted on the NPS PEPC website. The public notice began a public scoping comment period that closed on January 11, 2014. The National Park Service also held agency and public scoping meetings to gather input on the associated environmental assessment on September 18, 2013 and June 27, 2016. For a complete discussion about public involvement for the Sustainable Access Project, please see page 91 of the environmental assessment or review the documents available on the NPS PEPC website at <https://parkplanning.nps.gov/documentsList.cfm?projectID=48923>.

#### ***Representative Quote(s):***

**Corr. ID:** 10 Organization: Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542676

**Organization Type:** Unaffiliated Individual



**Representative Quote:** The public has not been fully informed of the facts and risks, and we take note that there is incomplete documentation provided online. Very few members of the public (less than twenty) appear to have been included in the scoping sessions.

### ***GA1000 - Impact Analysis: Impact Analyses***

**CONCERN STATEMENT:** (Concern ID: 59299) One commenter stated that the organization of the impact analysis by resource topic is difficult to understand.

**RESPONSE:** The organizational structure of the Sustainable Access Project Draft Environmental Assessment is similar to other environmental compliance documents prepared by the National Park Service. Impact topics are typically organized by their relationship to one another and in a manner that is most useful for creating a concise, focused document that avoids repetition. Furthermore, page 26 of the environmental assessment presents a table of the environmental consequences that would occur under each alternative and summarizes these impacts by topic to aid in comparing and providing a complete picture of the alternatives.

#### ***Representative Quote(s):***

**Corr. ID:** 8

**Organization:** Marin Conservation League

**Comment ID:** 542501

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Environmental Consequences and Cumulative Impacts. The discussion of environmental consequences is generally comprehensive and adequate, although the organization of the analysis, which takes each of the three alternatives and analyzes it topic by topic, makes it very difficult to assemble a complete picture of each of the three alternatives.

**CONCERN STATEMENT:** (Concern ID: 59300) One commenter stated that the impact analysis does not list what construction equipment would be used and where staging and stockpiling areas would be located.

**RESPONSE:** The Sustainable Access Project Draft Environmental Assessment presents different conceptual approaches for resolving the purpose of, and need for, action; therefore, it does not detail the elements of the construction phase of the project. The National Park Service anticipates, however, that equipment would be staged and soil stockpiled in disturbed areas where possible and away from buildings, walkways, parking areas, utilities, roadways, and permeable surfaces. The National Park Service would work closely with the selected construction contractor to designate suitable locations for staging equipment and stockpiling soil.

#### ***Representative Quote(s):***

**Corr. ID:** 8

**Organization:** Marin Conservation League

**Comment ID:** 542503

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Information as to where staging and stockpiling of equipment and fill material will take place, or what equipment will be, is also given short shrift.



## ***GA1050 - Impact Analysis: Cumulative Impacts***

**CONCERN STATEMENT:** (Concern ID: 59301) Commenters requested that the National Park Service define construction activities beyond "short-term," ensure that other proposed projects are coordinated with the Sustainable Access Project, and provide periodic updates on upcoming construction activities.

**RESPONSE:** In general, the use of "short-term" in the Sustainable Access Project Draft Environmental Assessment means lasting only as long as the construction phase of the project. The National Park Service recognizes that multiple projects are occurring in the vicinity of the project area and that construction periods may overlap or happen one after another. The impacts from these multiple projects occurring during similar time frames is captured under the cumulative impacts analysis. The Sustainable Access Project would be coordinated with the other projects described in the environmental assessment and any projects that may arise in the years following implementation. As stated on page 20 of the environmental assessment, the monument would inform visitors in advance of construction activities via a number of outlets, including the monument's website, various signs, the visitor center, and bus and shuttle drivers.

### ***Representative Quote(s):***

**Corr. ID:** 7

**Organization:** Not Specified

**Comment ID:** 542485

**Organization Type:** Unaffiliated Individual

**Representative Quote:** The timing of the project implementation should consider the timing of other proposed projects in the Redwood Creek corridor to make sure that implementation of all the projects is coordinated so as to cause the least overall detrimental environmental impact on the corridor.

**Corr. ID:** 8 Organization: Marin Conservation League

**Comment ID:** 542504

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Beyond that difficulty, we particularly appreciate that the cumulative impacts of "past, present, and reasonably foreseeable future projects" are noted under each topic. This approach, however, should give more attention to the cumulative and possibly overlapping timeframe for construction of each project. The projects listed are all intended to improve environmental conditions over the long term, but all will be constructed at some point. Construction of projects is typically dismissed in most EAs and similar environmental documents as "short-term." In fact, the listed projects, all occurring within the Redwood Creek Watershed along the Muir Woods Road corridor, will be constructed over a period of years ranging between 2017 and 2019. One can assume that work will occur in phases, some short in duration, some lengthy. The EA gives the reader no further indication as to how this might impact the travel corridor used by locals, although the EA does discuss how visitors to the monument will be protected from both individual and cumulative impacts. The local residents have already experienced the impacts of heavy equipment and major construction activity in the restoration project at Big Lagoon. The EA may not be able to predict exactly when construction will occur for each project, but some indication beyond "short-term" is needed. At a minimum, this could take the form of advance posting of construction activities, or a periodic update for locals, or an advance schedule designed to minimize overlap of construction activities for different projects.

**CONCERN STATEMENT:** (Concern ID: 59302) Commenters stated that impacts are likely to be significant because of the number of cumulative actions and the effects these actions could have on threatened and endangered species.

Concern-Response Report

Muir Woods Sustainable Access Project

PEPC ID: 48923

**RESPONSE:** The National Park Service recognizes that cumulative impacts from past, present, and reasonably foreseeable future actions could affect threatened and endangered species. However, it is anticipated that the Sustainable Access Project would result in an overall beneficial cumulative impact on threatened and endangered species. Establishing a Dipsea Trail footbridge, improving stormwater infrastructure, and rehabilitating riparian areas would improve habitat for threatened and endangered species and enhance water quality in Redwood Creek. The US Fish and Wildlife Service and National Marine Fisheries Service concur with the National Park Service that the proposed action is not likely to adversely affect listed species and their designated critical habitat. Furthermore, the Muir Woods Salmon Habitat Enhancement and Bridge Replacement Project would restore aquatic habitat in Redwood Creek. Restoration activities associated with this project, such as the placement of woody debris to create habitat for juvenile coho salmon, would benefit both coho salmon and steelhead trout, resulting in beneficial cumulative impacts.

***Representative Quote(s):***

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542774

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Even if some of these actions could have beneficial long-term impacts on Redwood creek, coho salmon, and steelhead, the negative short-term impacts on these and other vulnerable resources should not be minimized by segmented environmental review. Indeed, the EA recognizes that short-term environmental impacts during construction of all of these projects will be detrimental to the environment, including the health of Redwood Creek and the endangered and threatened species that depend on it. Combined with the short- and long-term detrimental impacts of the numerous other projects to be undertaken during the next several construction seasons, it is clear that the projects' combined effect could wipe out the few remaining coho salmon.

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542752

**Organization Type:** Unaffiliated Individual

**Representative Quote:** There can be no doubt that the cumulative effects of so many ground-disturbing activities are "significant" within the meaning of NEPA. See 40 C.F.R. § 1508.27 (defining significance).[1] The actions will be undertaken in the small area of the Redwood Creek watershed below Muir Woods (from Muir Woods to Muir Beach, where Redwood Creek spills into the Pacific Ocean), in many instances within Redwood Creek's riparian zone and in some cases even on its banks or in its bed. And the actions will take place at effectively the same time, or at least within the same year or period of several years. Indeed, nearly all of NEPA's "significance factors" are triggered:

- "Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas." Id. § 1508.27(b)(3). The actions impact the character and environmental health of a National Monument and threaten to further degrade designated critical habitat.
- "The degree to which the effects on the quality of the human environment are likely to be highly controversial." Id. § 1508.27(b)(4). NPS's larger effort to change the character of the Muir Woods area and the effects of these efforts on the environment are highly controversial.

- "The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks." Id. § 1508.27(b)(5). The impact of conducting so many actions within or immediately adjacent to designated critical habitat over such a short period of time are surely uncertain, and cry out for more thorough environmental review and public participation.
- "Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment." Id. § 1508.27(b)(7). As described above, the SAP relates to numerous other actions that have overlapping environmental effects.
- "The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources." Id. § 1508.27(b)(8). The SAP may adversely affect the character of Muir Woods National Monument, converting it from "an important demonstration of early 20th century conservation history," SAP EA 5, into a 21st century high-capacity tourist attraction. The SAP EA also acknowledges that numerous historic resources occur within the project area of the SAP and may be impacted by the expansion of numerous parking lots.
- "The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973." Id. § 1508.27(b)(9). Clearly, so many actions in and alongside a small creek that is designated critical habitat for coho salmon may adversely affect an endangered species and its critical habitat. The actions also may adversely affect steelhead and several other endangered or threatened species.

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542740

**Organization Type:** Unaffiliated Individual

**Representative Quote:** The Court could have been describing NPS's segmented environmental review of projects affecting the National Monument, including its preparation of a stand-alone EA for the SAP and a separate EA for the Muir Woods Road Project. NPS simply has not taken a hard look at the additional short and long-term impacts on Redwood Creek's coho salmon and steelhead caused by the SAP when combined with the impacts of other ongoing and reasonably foreseeable actions to be undertaken during the same timeframe.

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542725

**Organization Type:** Unaffiliated Individual

**Representative Quote:** NEPA requires federal agencies to consider the effects of their actions, including cumulative impacts. 40 C.F.R. §§ 1508.7, 1508.25(c), 1508.27(b)(7). Cumulative impacts are the impacts "on the environment which result[] from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." Id. § 1508.7. The cumulative impact requirement is designed to identify situations where "the total impact from a set of actions may be greater than the sum of the parts." Klamath-Siskiyou Wildlands Ctr. v. BLM, 387 F. 3d 989, 994 (9th Cir. 2004). As the Ninth Circuit has explained by way of example:

[T]he addition of a small amount of sediment to a creek may have only a limited impact on salmon survival . . . . But the addition of a small amount here, a small amount there, and still more at another point could add up to something with a much greater impact, until there comes a point where even a marginal increase means no salmon survive.

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542785

**Organization Type:** Unaffiliated Individual

**Representative Quote:** 'What is more, NPS has also failed to evaluate the short-term cumulative impacts of the numerous projects listed above on other aspects of the human environment, including the ability of emergency responders to access the National Monument and surrounding areas in the event of accidents, fire, or earthquake. Muir Woods road is frequently completely blocked by landslides. These impacts are likely to be significant too, given the large number of projects to be undertaken over the next several construction seasons.'

### ***MOU1000 - Memorandum of Understanding***

**CONCERN STATEMENT:** (Concern ID: 59303) One commenter stated that the National Park Service does not comply with the terms of the memorandum of understanding because it has not implemented erosion control treatments recommended under the 2012 Central Coast Coho Recovery Plan.

**RESPONSE:** In accordance with actions listed under article 4, section A, of the memorandum of understanding, the National Park Service produced a Stormwater Pollution Prevention Plan for the monument in January 2016. The Stormwater Pollution Prevention Plan was incorporated into phase 1 of the reservation system, which established parking barriers along Muir Woods Road to improve traffic safety and prevent parking on the road shoulder. Erosion and sediment control measures were installed adjacent to these barriers, as shown on page 54 of the draft environmental assessment. Implementation of the Sustainable Access Project would further control runoff by installing infiltration trenches in the Entry Plaza and in all parking lots. Discharge from these trenches would meet applicable water quality standards, such as those found in the Bay Area Stormwater Management Agencies Association Post-Construction Manual, and would not require additional treatment.

**Representative Quote(s):**

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542833

**Organization Type:** Unaffiliated Individual

**Representative Quote:** NPS's latest actions are not in keeping with the MOU. The MOU has four objectives, the first of which is to "protect, preserve and enhance the health of Redwood Creek watershed, including its salmonids." Other objectives include better traffic management and reduced congestion in the local communities, as well as safety improvements for visitors and residents. The MOU emphasizes the need for Best Management Practices to protect against further environmental damage during construction in a sensitive area. To meet the goals of the MOU, proposed projects must be carefully designed, managed, and coordinated. Project priorities and sequencing should respect and follow the recommendations for salmon recovery from the National Marine Fisheries Service's 2012 Central Coast Coho Recovery Plan. That plan incorporates the 2002 erosion study by Pacific Watershed Associates

Concern-Response Report

Muir Woods Sustainable Access Project

PEPC ID: 48923

(PWA) to inform prioritization of treatments necessary to control discharges of sediment. These treatments have yet to be properly implemented.

### ***ON1000 - Other NEPA Issues: General Comments***

**CONCERN STATEMENT:** (Concern ID: 59304) One commenter stated that the National Park Service should prepare an environmental impact statement because critical resources, such as salmonids, may be significantly affected and because the preparation of separate environmental assessments for multiple projects does not allow the National Park Service to take a "hard look" at these potentially significant impacts.

**RESPONSE:** The National Park Service recognizes that the concept of significance is central to environmental reviews under the National Environmental Policy Act. The Muir Woods National Monument Sustainable Access Project Finding of No Significant Impact succinctly states why implementation of the proposed action would not result in significant adverse impacts. Furthermore, the National Park Service has received concurrence from the US Fish and Wildlife Service, the National Marine Fisheries Service, and the California State Historic Preservation Office that the project would not adversely affect sensitive resources. The Muir Woods Road Improvement Project, which was analyzed in the Sustainable Access Project Draft Environmental Assessment as a cumulative action, would be implemented by the Marin County Department of Public Works, in consultation with the National Park Service, and the department is following the applicable requirements of the California Environmental Quality Act to determine impacts associated with that project.

#### ***Representative Quote(s):***

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542715

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Taken together, these actions also represent a significant impact on the character of the National Monument itself, and the original intent of William Kent to preserve this area for future generations. The proposed projects focus on the physical infrastructure needed to push more visitors through the Muir Woods Road/Redwood Creek "corridor" to the National Monument. In the process, Redwood Creek and its imperiled salmonids are taking a backseat to road widening and repairs and major trail expansions. The cumulative significance of changes to Muir Woods and the surrounding watershed lands cannot be concealed by yet two more segmented environmental reviews by NPS. An Environmental Impact Statement (EIS) is required.

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542695

**Organization Type:** Unaffiliated Individual

**Representative Quote:** The draft EA that is the subject of this comment letter-the Sustainable Access Project (SAP) EA-does not take a hard look at the impacts of the SAP in the Project's larger context, and thus obscures cumulatively significant impacts on protected species and other resources that mandate the preparation of an Environmental Impact Statement (EIS). The long list of recent, ongoing, and anticipated projects affecting the National Monument and its resources makes clear that the SAP is one significant part of a larger series of actions that impact the resources of the National Monument and larger area,

Concern-Response Report

Muir Woods Sustainable Access Project

PEPC ID: 48923

including endangered and threatened species. Indeed, NPS is concurrently undertaking independent NEPA review of the Muir Woods Road Improvement Project, which would affect the same area during the same time period.

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542788

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Notably, there are other NPS GGNRA precedents that show NPS is very much aware of the need to prepare an EIS in circumstances such as this. In 2009, NPS issued an EIS for its proposed Marin Headlands and Fort Baker Transportation Infrastructure and Management Plan. The goals and objectives of that plan were to provide infrastructure and access improvements to promote visitor travel to improve the visitor experience and enhance environmental quality, improve roads and trails to protect the environment and enhance safety and circulation, and reduce traffic congestion and improve safety at key locations and connecting roads. See Final EIS for Marin Headlands and Fort Baker Transportation Infrastructure and Management Plan, available at [https://www.nps.gov/goga/learn/management/upload/MH\\_FB-TIMP-Final-EIS\\_Main-Document.pdf](https://www.nps.gov/goga/learn/management/upload/MH_FB-TIMP-Final-EIS_Main-Document.pdf). It cannot be the law or even NPS policy that the environmental impacts of actions in and around Muir Woods National Monument and its Redwood Creek watershed, which have similar goals and objectives, can be analyzed serially, in separate EAs (or even Categorical Exclusions), rather than comprehensively evaluated in an EIS.

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542845

**Organization Type:** Unaffiliated Individual

**Representative Quote:** If evaluated carefully and together, the SAP and other ongoing and anticipated infrastructure projects in the Redwood Creek watershed may help reduce detrimental impacts on endangered coho salmon and threatened steelhead trout, achieve more sustainable visitation levels, and improve safety for both visitors and residents. However, all of these actions must be reviewed by NPS, other agencies, and the public through a comprehensive EIS, not through serial, segmented EAs. Only by taking a hard look at cumulative impacts, can we ensure that the SAP, Muir Woods Road Project, and other actions will provide the promised environmental benefits to Redwood Creek and its salmonids, and that the actions' negative impacts are mitigated to a less than significant level.

### ***PN1000 - Purpose and Need: Planning Process and Policy***

**CONCERN STATEMENT:** (Concern ID: 59305) One commenter stated that environmental review under the California Environmental Quality Act is required because of the potential for substantial adverse changes in the environment resulting from the Sustainable Access Project and Muir Woods Road Improvement Project.

**RESPONSE:** The California Environmental Quality Act applies only to decisions of all California state, regional, and local agencies. Because the Sustainable Access Project is a federal action, the California Environmental Quality Act is not applicable. However, the National Park Service will obtain encroachment permits from Marin County for any work done within the Muir Woods Road right-of-way. The Muir Woods Road Improvement Project would be implemented by the Marin County Department of Public Works, in consultation with the National Park Service, and the department is following the applicable requirements of the California Environmental Quality Act.

Concern-Response Report

Muir Woods Sustainable Access Project

PEPC ID: 48923



***Representative Quote(s):***

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542846

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Given that the SAP and Muir Woods Road Improvement Project will impact Marin County's right-of-way, environmental review under the California Environmental Quality Act is also required. The Trails EA also purported to be an Initial Study under CEQA because the project would involve work on land owned and managed by the State of California. Under CEQA too, a more-detailed Environmental Impact Report is required due to the significance of direct, indirect, and cumulative impacts. CEQA defines a significant effect on the environment as a substantial or potentially substantial adverse change in the environment. Pub. Res. Code section 21068; 14 Cal. Code Regs. 15382 (a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic and aesthetic significance).

***PN8000 - Purpose and Need: Objectives in Taking Action***

**CONCERN STATEMENT:** (Concern ID: 59306) One commenter stated that the purpose of, and need for, action should address local residents' access beyond the project area, in addition to serving visitors to the monument. The commenter stated that the reconfiguration of entries/exits in parking areas and establishing pedestrian crossings could adversely affect local residents using Muir Woods Road.

**RESPONSE:** In December 2015, the National Park Service approved a reservation system that will reduce congestion by reducing vehicle trips to the monument. Furthermore, the Sustainable Access Project would construct a single bi-directional driveway in the Annex Lot to improve vehicular circulation and reduce queuing along the road. The project would also establish a crosswalk at Conlon Avenue to limit the points at which pedestrians typically cross the road. It is anticipated that these actions, when taken together, would resolve long-standing problems with traffic congestion and reduce hazardous conditions for local residents travelling along Muir Woods Road.

***Representative Quote(s):***

**Corr. ID:** 8

**Organization:** Marin Conservation League

**Comment ID:** 542492

**Organization Type:** Unaffiliated Individual

**Representative Quote:** Two points are missing from the Purpose of and Need for the Action and Objectives sections. The first is the recognition that the proposed improvements occur in a context that extends beyond the immediate Monument environment and visitor experience. The improvements that involve Muir Woods Road, including exits and entries to parking areas and pedestrian crossings, should benefit not just visitors to Muir Woods, but also local residents and other travelers who use that road as one of three limited alternative routes out of Muir Beach for daily travel. They must contend frequently with the hazardous conditions created by visitor-related congestion on the County-owned and maintained road. By ignoring these other users who are affected by NPS actions, the EA becomes self-serving.

## ***VES4000 - Visitor Experience and Safety: Impact of the Proposal and Alternatives***

**CONCERN STATEMENT:** (Concern ID: 59308) One commenter stated that the National Park Service has not quantified how many more people would visit the monument as a result of the Sustainable Access Project or considered the impacts associated with increased visitation.

**RESPONSE:** Visitation levels discussed in the Sustainable Access Project Draft Environmental Assessment are based on extensive study and experience in managing visitation at the monument. Chapter 7 of the Golden Gate National Recreation Area and Muir Woods National Monument General Management Plan / Environmental Impact Statement established the indicators and standards to be used in managing visitor use at the monument. As described in the Muir Woods National Monument Reservation System Finding of No Significant Impact, these user capacity studies, indicators, and standards have resulted in a determination that the reservation system will reduce annual visitation to the monument from approximately 1,100,000 to 924,400 once implemented.

### ***Representative Quote(s):***

**Corr. ID:** 10

**Organization:** Morrison & Foerster on behalf of Mount Tam Task Force

**Comment ID:** 542838

**Organization Type:** Unaffiliated Individual

**Representative Quote:** NPS has not evaluated the impacts of an increase in visitation/use would have on Muir Woods National Monument and the surrounding environment.

The SAP and other foreseeable projects, including the road-widening project, open the door to a substantial increase in the number of buses bringing tourists to Muir Woods, Muir Beach, and surrounding areas. NPS has not quantified how many more people would visit Muir Woods as a result of the SAP and other foreseeable projects, evaluated visitor capacity of Muir Woods or nearby areas in terms of number of visitors, or considered the impacts that increasing the number of visitors will have on Muir Woods, nearby areas, and the environment. Indeed, NPS has not responded to requests since 1974 for an independent scientific capacity study to establish appropriate levels for Muir Woods visitation, despite the fact that federal funds were allocated in 2005 to conduct this study.

## ***WQ4000 - Water Resources: Impact of Proposal and Alternatives***

**CONCERN STATEMENT:** (Concern ID: 59307) One commenter noted that the environmental assessment does not discuss impacts on water quality as a result of existing runoff from parking areas.

**RESPONSE:** Though water quality testing has shown no appreciable differences in contaminants (e.g. heavy metals, petroleum-based compounds, total suspended solids) above and below Muir Woods parking areas, changes in the intensity and frequency of precipitation events and more frequent flooding associated with climate change could result in increased stormwater runoff and therefore increased levels of pollutants and soil erosion. Furthermore, page 46 of the Sustainable Access Project Draft Environmental Assessment states “Erosion of upstream roads and culverts results in sedimentation in the reach of Redwood Creek in the monument. Channel incision in the monument results in sediment loading in the downstream portions of Redwood Creek.” For these reasons, the proposed action aims to protect water quality in the Redwood Creek Watershed by improving stormwater management infrastructure and phasing out parking along Muir Woods Road. Please see concern statement identification numbers 59296 and 59303 (above) for more information regarding improving stormwater infrastructure.



***Representative Quote(s):***

**Corr. ID:** 8

**Organization:** Marin Conservation League

**Comment ID:** 544430

**Organization Type:** Unaffiliated Individual

**Representative Quote:** The EA does not mention the water quality issues associated with existing stormwater runoff from parking areas and Muir Woods Road into Redwood Creek, such that drainage improvements are needed. Is sediment the primary pollutant from this source, or are other pollutants noteworthy? What specific impacts are the drainage improvements intended to resolve?

**APPENDIX B**  
**CONSULTATION CORRESPONDENCE**

This page intentionally left blank.



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL MARINE FISHERIES SERVICE

West Coast Region  
777 Sonoma Avenue, Room 325  
Santa Rosa, California 95404

December 5, 2016

Refer to NMFS No: WCR-2016-5912

Aaron Roth  
Acting General Superintendent  
U.S. Department of the Interior  
National Park Service  
Golden Gate National Recreational Area  
Fort Mason, San Francisco, California 94123

*natural resources*  
TO: HATCH  
CY: MILESTONE

RECEIVED

DEC 08 2016

SUPERINTENDENT'S OFFICE

Re: Endangered Species Act Section 7(a)(2) Concurrence Letter for the Sustainable Access Project, Marin County, California

Dear Mr. Roth:

On November 8, 2016, NOAA's National Marine Fisheries Service (NMFS) received your request for a written concurrence that National Park Service's (NPS) implementation of the Sustainable Access Project in Muir Woods National Monument (MWNM), Marin County, California (hereafter "Proposed Project") is not likely to adversely affect (NLAA) species listed as threatened or endangered or critical habitats designated under the Endangered Species Act (ESA). This response to your request was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402, and agency guidance for preparation of letters of concurrence.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The concurrence letter will be available through NMFS' Public Consultation Tracking System [<https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts>]. A complete record of this consultation is on file at NMFS' Santa Rosa, California office.

### **Proposed Action and Action Area**

The NPS is proposing to improve visitor access and arrival facilities at MWNM to better manage visitor demand and transportation services, improve visitor experience and safety, and enhance natural and cultural resource preservation. These facilities include parking areas, bus or shuttle areas, stormwater management infrastructure, restrooms, and interpretive media. The Proposed Project will modify the Entry Plaza, Main Lot, Annex Lot, Conlon Lot, and former Nursery Area footprints, but will maintain the same number of parking spaces for privately owned vehicles as



currently exists. Though administrative access will be maintained in the Entry Plaza, existing parking spaces will be relocated and approximately 0.4 acre will be rehabilitated with native riparian vegetation. The Annex Lot will be reconfigured and restriped to accommodate approximately 125 parking spaces for privately owned vehicles. The Conlon Lot will be widened 6 to 8 feet to accommodate a two-way driveway and approximately 48 parking spaces for privately owned vehicles. A pedestrian trail will be developed on the perimeter of the lot near Conlon Creek. Visitors parking in the Conlon Lot will cross Muir Woods Road at the Conlon Avenue intersection by way of a delineated footpath. Existing roadside parking will be eliminated on the east side of Muir Woods Road between Conlon Avenue and the Muir Woods Road bridge, and the area will be revegetated with plants native to MWNM. A new lot will be developed in the former Nursery Area (Nursery Lot) and contain parking spaces for up to 48 privately owned vehicles. The structures in the former Nursery Area will be removed, and the area will require less than 0.3 acre of development. Because MWNM aims to work within the existing footprint of the former Nursery Area, minimal filling and grading is required to construct the Nursery Lot. One culvert will be installed during construction to convey an existing, non-fish bearing drainage, and impervious asphalt will be used to surface the Nursery Lot. Engineered stormwater management facilities (*i.e.*, infiltration trenches, designed and sized in accordance with Environmental Protection Agency guidance) will be used to treat the runoff from the Entry Plaza and all parking lots.

The trail between the Main and Annex Lots will be widened to 10 to 12 feet and improved through minor realignments and grading to address accessibility, and replacing deficient culverts at three non-fish bearing drainages with larger culverts or footbridges to correct drainage problems. The trail will be designed to incorporate drainage and erosion control measures, including stabilizing the downstream drainage channel to stop further downcutting and bank sloughing near the two crossings. The drainages at the trail crossings will receive additional riprap to armor the channel and possibly larger rocks or logs for grade control. The disturbed soil areas along the trail and drainage crossings will be planted with native plant material to help minimize soil erosion. If heavy equipment access is needed for the trail work, the contractor will access the site using the existing trail prism. The Proposed Project will also relocate the existing main lot restroom outside of the erosion hazard area, and a second restroom will be constructed near the former Nursery Area.

The segment of existing pedestrian trail along Muir Woods Road between the Main and Nursery Lots will be decommissioned and revegetated with plants native to MNWM. The Proposed Project will develop a new woodland pedestrian trail between the Annex Lot and Nursery Lot. Approximately 1,200 linear feet of disturbance will be required to construct the trail at a width of 6 to 8 feet. The trail will pass along the Redwood Creek side of the Annex and Nursery Lots, and will tie into the Dipsea Trail. Portions of the trail within or adjacent to the Annex and Nursery Lots will be developed within the existing footprint of the lots. If this alignment is not feasible, the trail will follow the perimeter of the two lots, which may require building the trail on fill. The segment of trail connecting the Annex and Nursery Lots will be approximately 570 feet and pass through Arroyo Willow Riparian Forest, Buckeye-Bay Laurel Forest and Coast Live Oak Woodland. A total of approximately 0.1 acres of vegetation will be disturbed. To minimize disturbance, retaining walls may be constructed with handrails. Small footbridges or

boardwalks will be built over any intermittent drainages along the trail route, and the trail will be no steeper than a 2% running slope.

The portion of the Dipsea Trail passing through the Annex Lot will be realigned to the northwest perimeter of the lot, and a new pedestrian footbridge will be installed at the Redwood Creek crossing. The pedestrian footbridge will likely be installed in the location of the existing wooden plank and placed roughly 14 feet above the creekbed. Bridge footings will be located outside the 100-year flood plain, and no instream work will be required. No trees will need to be removed and the existing Dipsea Trail will retain a similar alignment.

#### Project and Channel Access

Construction activities will require the use of trucks to haul materials from sources outside MWNM to work and staging areas in the Project area. Vehicle access to the Project area is available using Muir Woods Road via Panoramic Highway or State Highway 1. The main entrance to MWNM lies on the west side of Muir Woods Road. Parking areas associated with the Proposed Project are situated on both sides of Muir Woods Road. Construction crews can access the Dipsea bridge location through the existing Annex Lot. An earthen ramp will need to be constructed on the left bank to allow for equipment access required for installation of new bridge abutments on the upper banks of Redwood Creek. Equipment will access the north (right) bank using a temporary, free spanning bridge over the wetted channel. Access to the channel will not require the removal of any existing trees.

#### Construction Schedule

The proposed construction schedule spans from June 2018 thru December 2020. The Proposed Project will be phased over this period to accommodate visitor parking and allow for some space to be available for construction staging. Timing restrictions to protect coho salmon (*Oncorhynchus kisutch*) and steelhead (*O. mykiss*) will be applied to construction activities during this period; for example, bridge work over Redwood Creek will be restricted to the period between June 15 and October 31.

#### Interrelated/interdependent Effects

No interrelated/interdependent effects are anticipated from the Proposed Project.

#### Action Area

The action area for the Proposed Project encompasses the Redwood Creek channel longitudinally from approximately Muir Woods Visitor Center downstream to the Muir Woods Road Bridge, a distance of approximately 0.5 mile. Along this section of Redwood Creek, the action area extends from the creek channel through the northeast floodplain for approximately 600 feet, which encompasses all proposed parking area construction, trail work, and vegetation restoration. A small portion of the action area expands onto the southwest floodplain in the area where the Dipsea bridge footing will be constructed (an approximate 50-foot by 50-foot area of floodplain).

## **Action Agency's Effects Determination**

Construction of the Proposed Project, such as the Dipsea Trail bridge and culvert replacements, would require workers and equipment within the 100-year flood zone of Redwood Creek. However, work will not encroach into the active channel of Redwood Creek, and no dewatering or in-water work is proposed. NPS has determined the Proposed Project may affect, but is not likely to adversely affect coho salmon or steelhead, or their designated critical habitat, reasoning that impacts associated with implementation of the Proposed Project would be temporary and insignificant. In the long-term, NPS notes the Proposed Project would have beneficial effects for coho salmon and steelhead by improving the water quality and habitat conditions of Redwood Creek. Expected habitat improvements include re-vegetation, riparian growth and sediment reduction along the stream corridor from moving existing trails further from the creek, relocating Dipsea Trail bridge footings outside the 100-year floodplain, and constructing sediment infiltration trenches to treat parking lot run-off.

## **Consultation History**

On May 13, 2013, Rick Rogers of NMFS met with NPS personnel to view the Proposed Project site and discuss construction details. In May 2013 and March 2016, NPS conversed with Rick Rogers via email regarding critical habitat designations for coho salmon and steelhead in Redwood Creek.

## **ENDANGERED SPECIES ACT**

### **Effects of the Action**

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

The effects of the proposed action that are reasonably likely to occur include: sediment discharge into Redwood Creek resulting from construction activities, and limited vegetation damage or removal where construction takes place. Both of these impacts will likely be insignificant and/or discountable with regard to listed salmonids and their critical habitat. Sediment may be mobilized during earth-moving activities at the various proposed parking structures, and also may arise during trail work and Dipsea Trail bridge construction. However, the sheer distance of most sediment-discharging actions from Redwood Creek (except for the bridge, all are at least several hundred feet away), making sediment discharge into the creek unlikely, and thus discountable, for most Proposed Project components. For those components where sediment may enter a waterway (*e.g.*, Dipsea Bridge construction and drainage ditch

culvert replacement), the many minimization measures proposed by NPS<sup>1</sup> will likely ensure that any sediment impacts are insignificant both at the time of construction and into the future. Similarly, vegetation impacts will likely be minor and of short duration due to the NPS plan to limit vegetation removal to the maximum extent, and to revegetate all disturbed areas with native plant species. Within the heavily vegetated action area, the short-term loss of a small amount of vegetation for construction, and the ecosystem benefits resulting from revegetation and riparian corridor enhancement (*e.g.*, shading, allochthonous input, eventual large woody debris, *etc.*) to coho salmon, steelhead and their critical habitat will likely have an insignificant effect on both species' long-term survival and recovery, with improvements to their listed critical habitat to support future recovery of the species.

## Conclusion

Based on this analysis, NMFS concurs with NPS that the proposed action is not likely to adversely affect the subject listed species and designated critical habitats.

## Reinitiation of Consultation

Reinitiation of consultation is required and shall be requested by NPS or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this concurrence letter; or if (3) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16). This concludes the ESA portion of this consultation.

Please direct questions regarding this letter to Mr. Rick Rogers of my Santa Rosa office at 707-578-8552.

Sincerely,



FOR

Barry A. Thom

Regional Administrator

cc: Copy to file 151422WCR2016SR00373  
Copy to Chron File

---

<sup>1</sup> BMPs proposed include: limiting the area of disturbance; installation of temporary fencing; locating staging and storage areas to existing developed or disturbed areas; requiring equipment to be properly maintained; limiting soil disturbance; implementing erosion control measures prior to rain events; requiring aeration of disturbed soils prior to replanting; implementing dust control measures; revegetating and enhancing disturbed areas; implementing BMPs for drainage and sediment control; managing erosion control measures until vegetation has reestablished; avoiding wetland areas (outside the construction footprint); restricting construction activities during rain events; and restricting waste and contaminants from entering waterways.



This page intentionally left blank.

**OFFICE OF HISTORIC PRESERVATION  
DEPARTMENT OF PARKS AND RECREATION**

1725 23<sup>rd</sup> Street, Suite 100  
SACRAMENTO, CA 95816-7100  
(916) 445-7000 Fax: (916) 445-7053  
calshpo@parks.ca.gov  
www.ohp.parks.ca.gov



March 15, 2017

In reply refer to: NPS\_2013\_0919\_002

Craig Kenkel  
Acting Superintendent  
Golden Gate National Recreational Area  
Fort Mason # 201  
San Francisco, CA 94123

Re: Muir Woods Sustainable Access Plan, Muir Woods National Monument, Golden Gate National Recreation Area

Dear Mr. Kenkel:

Thank you for your January 10, 2017, letter continuing consultation regarding a proposed undertaking at Golden Gate National Recreation Area (GGNRA). The National Park Service (NPS) is consulting with the State Historic Preservation Officer (SHPO) in order to comply with Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. § 306108), as amended, and its implementing regulations at 36 CFR Part 800. In addition to the letter, NPS submitted maps showing the Area of Potential Effects (APE) and the preferred alternative.

The proposed undertaking, as previously described, involves redesigning the existing entry area to Muir Woods National Monument. Through its NEPA process, NPS selected Alternative 3 as the preferred alternative for the undertaking. The project description includes modifying the Entry Plaza, Main Lot, Annex Lot, Conlon Lot, and the former nursery area while maintaining the existing number of parking spaces at 232. The existing restroom in the Entry Plaza will be relocated outside the erosion hazard area.

The Annex lot would be redesigned to fit more vehicles, but would stay within its existing footprint. Activity in this area will avoid site CA-MRN-722H, but work in the lot will be subject to archaeological monitoring. The Conlon Lot will be widened six to eight feet to accommodate a two-way driveway and additional parking spaces. All road shoulder parking will be relocated, with those parking spaces being absorbed into a small new parking lot created in a previously-disturbed area across from Conlon Avenue that was recently the site of a native plant nursery.

A new pedestrian footbridge will be installed at the Dipsea Trail crossing at Redwood Creek. One culvert will be installed and a new restroom will be constructed in the new Nursery Lot, both of which will be monitored by an archaeologist. Finally, a new, 1,200-linear foot long and six to ten foot wide pedestrian trail will be built on fill along the perimeter of the Annex and Nursery Lots. This trail may also include low retaining walls and small footbridges over drainages along the trail route. Archaeological monitoring will occur in identified sensitive areas. Finally, NPS will install shallow infiltration trenches to treat runoff from the Entry Plaza and other parking lots, but will place them to avoid archaeologically sensitive areas.

For the reasons enumerated in the January 10 letter, including avoidance, monitoring, and design of new features following the Secretary of the Interior's Standards for the Treatment of Historic Properties, NPS proposes a Finding of No Adverse Effect for this undertaking. After reviewing the information submitted, the SHPO has no objection to this finding.

Thank you for seeking the SHPO's comments and considering historic properties as part of your project planning. If you have any questions or concerns, please contact Mark Beason, State Historian, at (916) 445-4047 or [mark.beason@parks.ca.gov](mailto:mark.beason@parks.ca.gov).

Sincerely,



Julianne Polanco  
State Historic Preservation Officer



# United States Department of the Interior




In Reply Refer to:  
08ESMF00-  
2017-I-0839

FISH AND WILDLIFE SERVICE  
Sacramento Fish and Wildlife Office  
2800 Cottage Way, Suite W-2605  
Sacramento, California 95825-1846

MAR 28 2017

## Memorandum

To: Acting General Superintendent, U.S. Department of Interior, National Park Service, Golden Gate National Recreation Area, Fort Mason, San Francisco, California

From: Coast/Bay Division Chief, Sacramento Fish and Wildlife Office, Sacramento, California 

Subject: Informal Consultation on the Muir Woods National Monument Sustainable Access Project in Marin County, California (National Park Service (NPS) file number A38 (GOGA-CP))

This memorandum responds to the NPS's November 4, 2016, letter requesting informal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed Muir Woods National Monument Sustainable Access Project (proposed project) near the City of Mill Valley, Marin County, California (NPS file number A38 (GOGA-CP)). We received your request for informal consultation on the proposed project on November 8, 2016, and the revised project description on March 13, 2017. At issue are the proposed project's effects on the federally listed threatened California red-legged frog (*Rana draytonii*) and threatened northern spotted owl (*Strix occidentalis caurina*). This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act), and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR 402). Critical habitat has been designated for the California red-legged frog and northern spotted owl but does not occur within the action area for the proposed project.

The Federal action we are consulting on is the NPS's proposal to improve visitor access and arrival facilities at Muir Woods National Monument to better manage visitor demand and transportation services, improve visitor experience and safety, and enhance preservation of natural and cultural resources. These facilities include parking areas, bus and/or shuttle areas, stormwater management infrastructure, restrooms, and interpretive media. Pursuant to 50 CFR 402.12(j), you submitted a biological assessment (Horizon and Environment, LLC 2016) for our review and requested concurrence with the findings presented therein. These findings conclude that the proposed project may affect, but is not likely to adversely affect the California red-legged frog and northern spotted owl and would have no effect on the federally threatened marbled murrelet (*Brachyramphus marmoratus*).

### Description of the Proposed Project

The proposed project will modify the footprints of the Entry Plaza, Main Lot, Annex Lot, Conlon Lot, and the former Nursery Area, but will maintain the same number of parking spaces for privately owned vehicles as currently exists (*i.e.*, 232 spaces) (Figure 1). Though administrative access will be maintained in the Entry Plaza, existing parking spaces will be relocated further away from



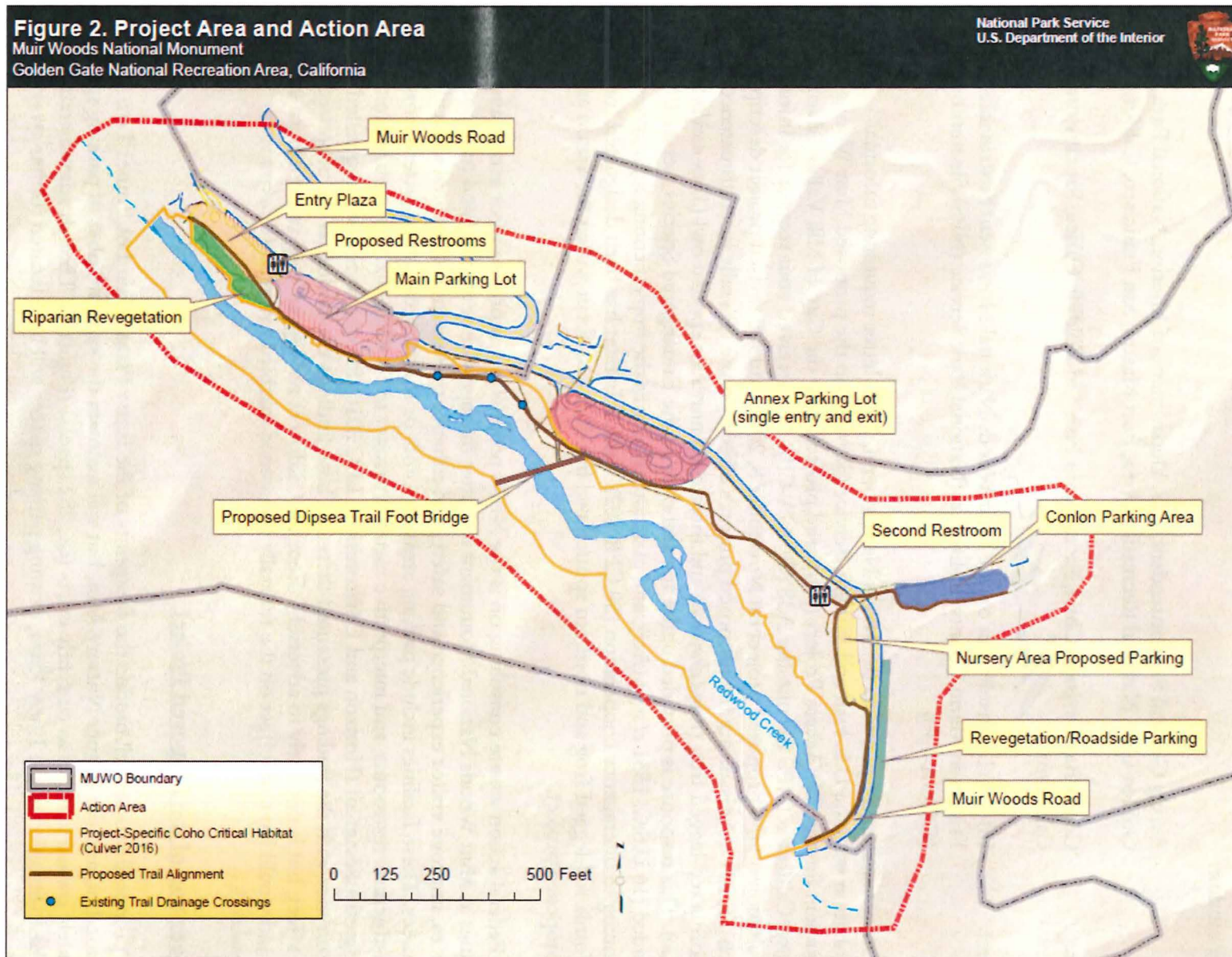


Figure 1. Action area for the proposed project (copied from Figure 2 in Horizon and Environment, LLC 2016).

Redwood Creek, and approximately 0.4 acre will be rehabilitated with native riparian vegetation. Parking for persons with disabilities will be relocated to the Main Lot, with approximately 11 spaces available and an access point for passenger drop-off. The Main Lot will also maintain its existing footprint and contain approximately 18 parking spaces for buses, shuttles, and commercial use vehicles. The Main Lot will likely need to be restriped to meet disability parking requirements and to accommodate two additional bus spaces.

The Annex Lot will be reconfigured and restriped to accommodate approximately 125 parking spaces for privately owned vehicles. The Annex Lot will be designed with one-way aisles and a single entry and exit at the southern end of the lot to promote efficient vehicular circulation.

The Conlon Lot will be widened 6 to 8 feet to accommodate a two-way driveway and approximately 48 parking spaces for privately owned vehicles. A pedestrian trail will be developed on the perimeter of the lot near Conlon Creek. Visitors parking in the Conlon Lot will cross Muir Woods Road at the Conlon Avenue intersection by way of a delineated footpath. Existing roadside parking will be eliminated on the east side of Muir Woods Road between Conlon Avenue and the Muir Woods Road bridge, and the area will be revegetated with plants native to Muir Woods National Monument.

A new lot will be developed in the former Nursery Area (an existing maintenance and storage area also referred to as the Nursery Lot) and contain parking spaces for up to 48 privately owned vehicles. The structures in the former Nursery Area will be removed, and the area will require less than 0.3 acre of development. Because Muir Woods National Monument aims to work within the existing footprint of the former Nursery Area, minimal filling and grading will be necessary to construct the Nursery Lot. One culvert will be installed during construction to accommodate an existing drainage on site. Impervious asphalt will be used to surface the Nursery Lot, and the lot will be designed to promote one-way traffic with one entrance, one exit, and a single driveway.

Construction activities for the parking areas will involve dumping rock and other material, grading parking area base to match proposed grades, spreading aggregate base across the surface, and using a paving and roller machines to install asphalt to the surface. Work at the Nursery Lot will also include clearing and grubbing of vegetation including some trees. Other construction equipment will include front-end loaders, excavators, skid steers, and bulldozers. Construction staging and material storage will be located on the existing parking areas within Muir Woods National Monument and at the Nursery Lot following preparation of the staging and lay down area. Sand, rock, and gravel and paving materials will be obtained from NPS-approved commercial sources near Muir Woods National Monument.

Engineered stormwater management facilities will be used to treat the runoff from the Entry Plaza and all parking lots. Shallow excavated ditches lined with filter strip sand and topped with stone to form a subsurface basin (where water is stored until it infiltrates into the soil) will be used to treat stormwater. This system is commonly known as an infiltration trench. The infiltration trenches will be designed and sized in accordance with U.S. Environmental Protection Agency guidance. The largest infiltration trenches will be associated with the Main and Annex Lots. These trenches will be approximately 0.04 acre. The Entry Plaza, Conlon Lot, and Nursery Lot will have infiltration trenches covering approximately 0.012 to 0.016 acre. The infiltration trenches will be installed near the parking lots.

The trail between the Main and Annex Lots will be improved and widened to 10 to 12 feet. Improvements to the trail will include minor realignments and grading to improve accessibility and replacement of deficient culverts at three locations with larger culverts or footbridges to correct

drainage problems. The trail will be designed to incorporate drainage and erosion control measures, including stabilizing the downstream drainage channel to stop further downcutting and bank sloughing near the two crossings. The drainages at the trail crossings will receive additional riprap to armor the channel and possibly larger rocks or logs for grade control. The disturbed soil areas along the trail and drainage crossings will be planted with native plant material to help minimize soil erosion. If heavy equipment access is needed for the trail work, the contractor will access the site using the existing trail prism. The proposed project will remove the restroom near Redwood Creek in the Entry Plaza. The restroom will remain in the Entry Plaza but be relocated outside of the erosion hazard area and will be sized to accommodate peak season visitation levels. The relocated restroom will not impede access to the Entry Plaza. A second restroom will be constructed near the former Nursery Area to accommodate visitors parking at the southern end of the project area and will also be sized to meet peak season visitation levels.

The segment of existing pedestrian trail along Muir Woods Road between the Main and Nursery Lots will be decommissioned and revegetated with plants native to Muir Woods National Monument. The proposed project will develop a new woodland pedestrian trail between the Annex Lot and Nursery Lot. Approximately 1,200 linear feet of disturbance will be required to construct the trail at a width of 6 to 8 feet. The trail will pass along the Redwood Creek side of the Annex and Nursery Lots, and will tie into the Dipsea Trail. Portions of the trail within or adjacent to the Annex and Nursery Lots will be developed within the existing footprint of the lots. If this alignment is not feasible, the trail will follow the perimeter of the two lots, which may require building the trail on fill. The segment of trail connecting the Annex and Nursery Lots will be approximately 570 feet and pass through arroyo willow riparian forest, buckeye-bay laurel forest, and coast live oak woodland. A total of approximately 0.2 acre of vegetation will be disturbed. To minimize disturbance, retaining walls may be constructed with handrails. Small footbridges or boardwalks will be built over any intermittent drainages along the trail route, and the trail will be no steeper than a 2 percent running slope. New interpretive media will be located along this new trail.

The portion of the Dipsea Trail passing through the Annex Lot will be realigned to the northwest perimeter of the lot, and a new pedestrian footbridge will be installed at the Redwood Creek crossing. The pedestrian footbridge will likely be installed in the location of the existing wooden plank and placed roughly 14 feet above the creek bed so that the north side of the bridge will be at the same grade as the Annex Lot. Figure 1 shows the changes that will occur under the proposed project. No trees will need to be removed, and the existing Dipsea Trail will retain a similar alignment.

The proposed project will establish additional signs directing visitors to the Entry Plaza and to local trails as a means to improve wayfinding at Muir Woods National Monument. The Entry Plaza will be furnished with new interpretive media telling the story of natural, historic, and cultural resource stewardship at Muir Woods National Monument. The segment of trail between the Main Lot and Annex Lot will also be furnished with interpretive media.

The proposed project will also remove two lift stations located in the former Nursery Area and northeast of the Conlon Lot, which will be replaced with a single modern 40,000 gallon lift station located near the Nursery Lot entrance. The replacement lift station will be more efficient than the existing units and eliminate the need for double pumping waste water. An underground power line and sewer lines will be installed to connect the lift station to the existing lines. The new lift station will be designed to accommodate the new restroom. The structures in the former Nursery Area will be removed, and the area will require less than 0.4 acre of development.

## **Project and Channel Access**

Construction activities will require the use of trucks to haul materials from sources outside of Muir Woods National Monument to work and staging areas in the project area. Vehicle access to the project area is available using Muir Woods Road via Panoramic Highway or State Highway 1. The main entrance to Muir Woods National Monument lies on the west side of Muir Woods Road. Parking areas associated with the proposed project are situated on both sides of Muir Woods Road (Figure 1). Construction crews can access the Dipsea bridge location through the existing Annex Lot. An earthen ramp will need to be constructed on the left bank to allow for equipment access required for installation of new bridge abutments on the upper banks of Redwood Creek. Equipment will access the north (right) bank using a temporary, free spanning bridge over the wetted channel. Access to the channel will not require the removal of any existing trees.

## **Construction Schedule**

The proposed construction schedule spans from June 2018 thru December 2020. The proposed project will be phased over this period to accommodate visitor parking and allow for some space to be available for construction staging. Timing restrictions to protect federally listed species, as described in the Avoidance and Minimization Measures section below will be applied to construction activities during this period.

## **Avoidance and Minimization Measures**

NPS, Muir Woods National Monument, and their contractors will implement the following measures to avoid and minimize the effects of the proposed project on the California red-legged frog, northern spotted owl, and other special-status species and their habitats:

### General Measures

1. All resource protection measures will be clearly stated in the construction specifications, and workers will be instructed to avoid conducting activities outside the project area.
2. A preconstruction training will be held to inform contractors about sensitive areas, including natural and cultural resources.
3. The project limits will be delineated with temporary fencing. All surface disturbance will be confined to the delineated construction zone. All temporary fencing shall be completely removed from the project area and properly disposed of upon completion of proposed project activities.
4. Staging and storage areas for construction vehicles, equipment, materials, and soils will be sited in previously disturbed or paved areas approved by NPS. These areas will be outside of high visitor use areas and will be clearly identified in advance of construction.
5. Contractors will be required to properly maintain construction equipment to minimize noise, and construction vehicle engines will not be allowed to idle for extended periods.
6. All tools, equipment, barricades, signs, and surplus materials will be removed from the project area upon completion of the proposed project.



Geology and Soils

1. Disturbance to soils will be avoided as much as possible and contained to as small a footprint as possible.
2. Topsoil heavily infested with invasive, nonnative plants will be removed. Non-infested topsoil will be salvaged, stored according to soil conservation guidelines, and replaced once construction is complete.
3. Erosion control measures that provide for soil stability and prevent movement of soils during rain events, such as silt fences, will be implemented.
4. Any ground surface temporarily disturbed during construction will be aerated and replanted with native vegetation to reduce compaction and prevent erosion.
5. The contractor will control dust within the construction limits, including active haul roads and staging areas. Water will be applied at the locations, rates, and frequencies ordered by the contracting officer.

Vegetation

1. Muir Woods National Monument will develop a detailed revegetation and rehabilitation plan for enhancing areas disturbed by the proposed project. The primary objective of the plan will be to reestablish a self-sustaining native plant community and ensure soil stability. Disturbed area treatments will include grading to natural contours; replacing stockpiled topsoil; and mulching, replanting, or reseeded with native vegetation. Planted areas will be monitored annually after construction for a minimum of five years to determine whether revegetation efforts were successful and if remedial actions such as erosion control; invasive, nonnative plant species control; or replacement plantings are necessary.
2. Disturbance to particular species such as coast redwood, California bottlebrush grass, leopard lily, and California buckeye will be avoided to the greatest extent possible.
3. Prior to construction, NPS will survey for rare California plants in areas where they may occur in vegetated construction zones. Surveys for state and locally (California Native Plant Society) listed plants that may occur in the proposed project area will be conducted at appropriate times. If state or locally listed plants are found and cannot be avoided, seeds will be collected and propagated before revegetating disturbed areas. Revegetated areas with rare plants will be monitored for up to three years, and remedial actions will be taken to ensure that rare plants are reestablished.
4. The contractor will prevent or minimize establishment and spread of nonnative vegetation and noxious weeds by: minimizing soil disturbance; pressure washing vehicles; covering haul vehicles; limiting vehicle and equipment parking to the project area; obtaining all fill, rock, or additional topsoil from the project area or obtaining weed-free material from approved sources outside the monument.

Water Resources and Hydrological Processes

1. Best management practices (BMPs) for drainage and sediment control, as identified and used by NPS, will be implemented to prevent or reduce nonpoint source pollution and minimize soil loss and sedimentation in drainage areas. These practices may include, but are not limited to, silt fencing, filter fabric, temporary sediment ponds, check dams of pea gravel-filled burlap bags or other material, and/or immediate mulching of exposed areas to minimize sedimentation and turbidity impacts as a result of construction activities. The placement and specific measures used will be developed in coordination with a Qualified Stormwater Pollution Prevention Plan Developer.
2. Any erosion control materials used shall not entrap animals. Jute mesh, loose, open weave textile fiber netting, burlap or non-binded materials (*e.g.*, rice straw) shall be used for erosion control or other purposes. Tightly woven fabric such as jute should have mesh size <1 centimeter while loosely woven materials be > 6 centimeters to avoid entrapment. No plastic mono-filament matting shall be used for erosion control.
3. Erosion control measures will be left in place at the completion of construction to avoid adverse impacts on water resources, after which time Muir Woods National Monument will be responsible for maintenance and removal once vegetation is established.
4. Wetlands will be identified by qualified Muir Woods National Monument staff or certified wetland scientists and clearly marked before construction work. Construction activities will be performed with caution to prevent damage caused by equipment, erosion, siltation, or pollutant discharges.
5. To the maximum extent practicable, no construction activities will occur during rain events or within 24 hours following a rain event.

Threatened and Endangered Species

1. Prior to any construction-related activities, a training session shall be required for all contractors, partners, and NPS staff participating in proposed project-related activities in the project area. Training will be conducted by a Service-approved biologist to familiarize personnel about sensitive resources in the project area. Personnel will be provided with a brief life-history and physical description of the California red-legged frog, northern spotted owl, marbled murrelet, coho salmon, steelhead, and other sensitive wildlife in the area. Training will include: staff resource contact information; identification of sensitive resources; the limits of the work area; general BMPs; and appropriate actions to take upon encountering special-status species or other wildlife. All attendees shall sign an attendance sheet along with their printed name, company or agency, email address, and telephone number.
2. No construction activities will occur at night or during dawn or dusk to minimize impacts on wildlife that are most active during these times, such as the northern spotted owl and California red-legged frog.
3. The contractor will be required to keep all waste and contaminants contained and remove them daily from the work site.

4. Access and/or construction below ordinary high water shall be limited to June 15 to October 31 to minimize potential adverse effects to salmonid spawning and movement. The actual work window may be a subset of that time, and will depend upon the current water year, creek conditions, and timing of salmonid migrations.
5. The following measures will be implemented to minimize potential adverse effects on the northern spotted owl:
  - a. If construction commences between February 1 and July 31, NPS shall conduct pre-construction surveys for northern spotted owl in suitable nesting habitat.
  - b. If northern spotted owl nests are detected during pre-construction surveys, no work that would raise noise levels above ambient background levels shall be conducted within 0.25 mile of an active nest.
  - c. Within northern spotted owl habitat, disturbance to native trees greater than 10 inches in diameter at breast height shall be avoided where feasible. No suitable nest trees will be removed.
6. The following measures will be implemented to minimize potential adverse effects on the marbled murrelet:
  - a. If construction commences between March 15 and September 15, NPS shall conduct inland preconstruction surveys for within 0.25 mile of potential marbled murrelet nesting habitat. Surveys will be conducted in accordance with *Methods for Surveying Marbled Murrelets in Forests: A Revised Protocol for Land Management and Research* (Evans Mack *et al.* 2003).
  - b. If marbled murrelet breeding activity is detected during pre-construction surveys, no work that would raise noise levels above ambient background levels shall be conducted within 0.25 mile of an active nest.
7. The following measures will be implemented to minimize potential adverse effects on the California red-legged frog:
  - a. A reconnaissance-level survey for the California red-legged frog shall be conducted by a Service-approved biologist within 48 hours prior to starting work in areas that provide potentially suitable habitat.
  - b. If no California red-legged frogs are found within the work area during the survey, then the work may proceed. If a California red-legged frog is observed, NPS will re-initiate consultation with the Service to determine appropriate avoidance and minimization measures. Any sightings and/or injuries of California red-legged frogs shall be reported to the Service within 24 hours.
  - c. A Service-approved biologist will supervise construction activities within suitable habitat near Redwood Creek.
  - d. Pipes, conduits and other materials that could provide shelter for California red-legged frogs shall be stored above ground level to reduce the potential for California red-legged frogs to climb into the conduits and other materials.

## **Habitats and Occurrences near the Action Area**

### **Habitats within the Action Area**

The proposed project will occur along the existing roads, parking lots, bus and shuttle turnarounds, passenger unloading areas, and pathways of Muir Woods National Monument where sounds from vehicular traffic and other human activities occur on a daily basis, year-round. An estimated 1,800-2,900 patrons visit Muir Woods National Monument during the off season (*i.e.*, November through March), with approximately 3,600-4,400 visitors during the peak months (June through August). The proposed project area and action area are shown in Figure 1.

Muir Woods National Monument lies within the oblong-shaped Redwood Creek watershed. The headwaters of Redwood Creek originate on the southwestern slopes of Mount Tamalpais flowing south to form Redwood Canyon and the heart of Muir Woods National Monument. Downstream of Muir Woods National Monument, the creek opens up to Frank Valley and a relatively broad alluvial floodplain. Redwood Creek continues south through the valley before flowing into the Big Lagoon area and into the Pacific Ocean at Muir Beach. The watershed is largely undeveloped, protected forest land managed by the Marin Municipal Water District, California State Parks (Mount Tamalpais State Park), and NPS (Muir Woods National Monument and the Golden Gate National Recreation Area at Muir Beach). Muir Woods Road passes through the action area.

Riverine habitat in the action area consists of Redwood Creek. Redwood Creek is a perennial stream with flows that vary from very low flows during spring and summer to high, flashy flows during the winter. As Redwood Creek enters Muir Woods National Monument, it is characterized by a slope of less than 2 percent and gravel and cobble bed sediments. The creek bed itself is largely unvegetated. The margins of the channel and small in-channel bars support some herbaceous vegetation such as iris-leaved rush, lady fern, forget-me-not, coastal hedgenettle, giant chain fern, umbrella sedge, common rush, horsetail, coltsfoot, and fringed willowherb. Within Muir Woods National Monument, Redwood Creek is constrained within the steep, narrow Redwood Canyon. During the 1930's, the Civil Conservation Corps installed check dams and rock revetments along approximately 57 percent of the creek channel within Muir Woods National Monument. These modifications altered natural hydrologic processes, including bank erosion, meandering, and flooding, and resulted in channel widening. The check dams have since been removed but the revetments remain on portions of the creek. Although some natural processes have returned, the creek has more riffle habitat and less deep water pool habitat than would naturally occur within a similarly sloped stream, and less large woody debris.

Several intermittent tributaries or ephemeral culverts discharge drainage from the adjacent slopes into Redwood Creek within the boundaries of the action area. Smaller tributaries and drainages experience seasonal flows of varying degrees. Conlon Creek is the main tributary, draining the steep hillslopes of Camino del Canyon northwest of Muir Woods Road. In general, the location of these habitats near existing roads, parking lots, and trails result in frequent disturbance and a mix of native and non-native ruderal species. Much of these areas remain largely unvegetated with some vegetation occurring along the margins. Vegetation may include a mix of sword fern, redwood sorrel, sedge, California blackberry, Western bower, French broom, tall false oat, coastal burnweed, poison hemlock, forget-me-not, peppermint, and crocosmia.

Redwood/Douglas-fir forest is the most commonly occurring habitat in the action area as well as the Redwood Creek watershed. Most of the area outside of the alluvial flats of Redwood Creek supports this vegetative community. Muir Woods National Monument includes the most intact old-growth coast redwood forest in the San Francisco Bay Area. Some redwood trees in Muir Woods

National Monument may be as much as 1,000 years old. In general, redwoods are dominant in the northern portion of the action area with California bay laurel and Douglas-fir present. Moving downstream, redwood species density decreases and Douglas-fir becomes increasingly co-dominant or dominant. Other tree species may also be present in this community including California bay laurel, coast live oak, big leaf maple, tan oak, Pacific madrone, and near Redwood Creek, red alder. Commonly occurring understory vegetation includes California hazel, California spikenard, redwood sorrel, sword fern, lady fern, and California blackberry.

The alluvial flats adjacent to Redwood Creek support a riparian forest comprised primarily of red alder. Arroyo willow may also be present or even co-dominant in areas. Other tree species that occur more infrequently in this vegetative community include California bay laurel, big leaf maple, California buckeye, and coast live oak. Common understory plants include California hazel, creekside dogwood, California blackberry, and traveler's joy. Common understory herbs include sword fern, cow parsnip, and stinging nettle, and non-native forget-me-not and veldt grass. Mixed hardwood forest is located in the south and southeast portion of the action area, specifically near the Conlon Lot and Nursery Lot. This variable community is predominately comprised of California bay laurel and coast live oak. Along the mesic (moist) boundary of this community (*e.g.*, near the Entry Plaza) is the redwood/Douglas-fir community, while along the xeric (dry) boundary (*e.g.*, on the hillslopes above Conlon Lot) are coastal scrub and grassland communities. Understory vegetation can be highly variable as well depending on the location in the action area, the topography, the microclimatic conditions, the canopy cover, and the level of past and current level of disturbance. Common understory species may include coyote brush, California blackberry, poison oak, traveler's joy, forget-me-not, and French broom.

California buckeye woodland occurs along the lower portion of the Conlon Creek drainage, adjacent to Muir Woods Road and the Nursery Lot. California buckeye dominates this community, with some very large specimens present (trees greater than 24 inches diameter at breast height). California bay laurel, coast live oak, or red alder may be present or co-dominant in transition zones between other communities. Common understory plants include California blackberry, poison oak, cow parsnip, and forget-me-not.

### California Red-legged Frog

The action area lacks deep pools or slack water areas suitable for California red-legged frog breeding, and there are no recorded observations of the California red-legged frog at Muir Woods National Monument. Redwood Creek provides suitable non-breeding aquatic habitat, and the adjacent forests provide suitable upland dispersal habitat for the California red-legged frog within the action area. There are two known occurrences of the California red-legged frog within two miles (dispersal distance) of the action area: (1) seven adult California red-legged frogs observed in 2003 in a small pond adjacent to Redwood Creek near the Muir Beach parking lot about 1.6 miles south (downstream) of the action area (California Natural Diversity Database (CNDDB) occurrence number 104, California Department of Fish and Wildlife (CDFW) 2016); and (2) one adult California red-legged frog captured in October 2007 in a small man-made pond on the south side of Green Gulch about 2.0 miles south of the action area (CNDDB occurrence number 971, CDFW 2016). Based on the known occurrence of the California red-legged frog within the Redwood Creek watershed within dispersal distance and the availability of suitable non-breeding aquatic and upland habitat for the California red-legged frog within the action area, the Service believes the California red-legged frog has a moderate potential to occur within the action area for the proposed project.

### Northern Spotted Owl

Northern spotted owls in Muir Woods National Monument have been documented nesting in a variety of trees including coast live oak, California bay laurel, and tan oak, some of which have a relatively small diameter. The northern spotted owl most commonly nests in old coast redwood trees and Douglas-fir trees. One of the primary threats to the northern spotted owl is competition with the aggressive barred owl. When northern spotted owl monitoring began in 1999, two pairs of northern spotted owls occupied Muir Woods National Monument, but northern spotted owls have not established an activity center within the boundaries of Muir Woods National Monument since 2010 (Ellis and Harrigan 2016). A breeding pair of barred owls was first documented in Muir Woods National Monument in 2007, with barred owls occupying and/or breeding in Muir Woods National Monument through 2015. As part of a research project, radio tags tracked the movements of the barred owl pair dwelling in Muir Woods National Monument. The male barred owl perished in 2015, and no barred owl detections occurred in Muir Woods National Monument during the 2016 surveys. With the nesting barred owl pair gone from Muir Woods National Monument, it is likely that the northern spotted owl will move back to historic nesting areas previously occupied on Redwood Creek across from the Entry Plaza and farther into Muir Woods National Monument (Horizon and Environment, LLC 2016). Therefore, based on the prior known occurrence of the northern spotted owl within the action area and the recent absence of its competitor the barred owl from the action area, the Service believes the northern spotted owl is likely to occur within the action area.

### Conclusion

The Service concurs that the proposed project is not likely to adversely affect the California red-legged frog because: (1) no suitable breeding habitat for the California red-legged frog occurs within the action area; (2) the majority of the work will be restricted to developed and disturbed areas; (3) the proposed project will result in a net increase in riparian habitat along Redwood Creek due to the relocation of parking spaces away from the creek and revegetation with suitable native riparian plant species; (4) the avoidance of work at night, during dawn and dusk, during rain events, and within 24 hours after a rain event when California red-legged frogs are most likely to disperse through the action area; (5) a Service-approved biologist will conduct pre-construction surveys and will supervise construction activities within suitable habitat along Redwood Creek; (6) all proposed project construction personnel will be trained by a Service-approved biologist in the identification of the California red-legged and the implementation of the avoidance and minimization measures; (7) NPS will reinstate consultation with the Service in the event a California red-legged frog is observed within the action area; and (8) the implementation of water quality BMPs will minimize the potential for the degradation of aquatic habitat for the California red-legged frog.

The Service concurs that the proposed project is not likely to adversely affect the northern spotted owl because: (1) no trees suitable for northern spotted owl nesting will be removed; (2) pre-construction surveys will be conducted for any work occurring within suitable nesting habitat during the northern spotted owl's nesting season (February 1 – July 31); (3) no work that would raise noise levels above ambient background levels will be conducted within 0.25 mile of an active northern spotted owl nest; (4) northern spotted owls residing in or near Muir Woods National Monument are habituated to high levels of vehicular and pedestrian traffic and noise in the action area; and (5) the proposed project will not result in an increase in public access or the number of visitors to Muir Woods National Monument.

Therefore, unless new information reveals effects of the proposed project that may affect listed species in a manner or to an extent not considered, or a new species is listed, no further action pursuant to the Act is necessary for the proposed project.

If you have any questions regarding this memorandum, please contact Joseph Terry (joseph\_terry@fws.gov), Senior Biologist, or Ryan Olah (ryan\_olah@fws.gov), Coast/Bay Division Chief, at the letterhead address, or telephone (916) 943-6721 or (916) 414-6623..

**LITERATURE CITED**

California Department of Fish and Wildlife (CDFW). 2016. California Natural Diversity Database. RareFind version 5. Natural Heritage Division. Sacramento, California.

Ellis, T, and K. Harrigan. 2016. Monitoring northern spotted owls on federal lands in Marin County, California: 2013 report. Natural Resource Report NPS/SFAN/NRR—2016/1180. National Park Service, Fort Collins, Colorado.  
[http://science.nature.nps.gov/im/units/sfan/monitor/spotted\\_owls.cfm](http://science.nature.nps.gov/im/units/sfan/monitor/spotted_owls.cfm). Accessed on January 18, 2017.

Evans Mack, D., W. P. Ritchie, S. K. Nelson, E. Kuo-Harrison, P. Harrison, and T. E. Hamer. 2003. Methods for surveying Marbled Murrelets in forests: a revised protocol for land management and research. Pacific Seabird Group.  
[https://www.pacificseabirdgroup.org/publications/PSG\\_TechPub2\\_MAMU\\_ISP.pdf](https://www.pacificseabirdgroup.org/publications/PSG_TechPub2_MAMU_ISP.pdf). Accessed on January 18, 2017.

Horizon and Environment, LLC. 2016. Muir Woods National Monument Sustainable Access Project Biological Assessment. November. Prepared by Horizon and Environment, LLC, Oakland, California. Prepared for National Park Service/U.S. Department Of Interior, Muir Woods National Monument, Mill Valley, California, and Golden Gate National Parks Conservancy, San Francisco, California. 50 pp. plus appendices.



This page intentionally left blank.

----- Forwarded message -----

From: **Rick Rogers - NOAA Federal** <rick.rogers@noaa.gov>

Date: Wed, Apr 5, 2017 at 3:40 PM

Subject: **Re: Sustainable Access Project plan changes**

To: "Brown, Darren" <darren\_brown@partner.nps.gov>

Cc: "'Steven\_culver@nps.gov' (Steven\_culver@nps.gov)" <Steven\_Culver@nps.gov>

hi steve and darren,

I've reviewed your proposed changes to the Sustainable Access Project at Muir Woods National Monument as conveyed via letter from NPS to NMFS dated February 24, 2017, and I agree with your determination that further consultation on the project due to the proposed changes is not warranted. The proposed replacement of two sewer lift stations with one, larger lift station located near the Nursery Lot entrance is unlikely to result in any new impacts above and beyond those considered in the original consultation. The new lift station will be located more than two hundred feet from Redwood Creek or any tributaries, well outside the active stream channel and riparian corridor. If you have any questions or concerns regarding this email, please feel free to contact me either via email or at 707-578-8552.

cheers,

rick

--

**Rick Rogers**

*Fish Biologist*

*NOAA Fisheries West Coast Region*

*U.S. Department of Commerce*

Office: 707-578-8552

Mobile: N/A

[rick.rogers@noaa.gov](mailto:rick.rogers@noaa.gov)

[www.westcoast.fisheries.noaa.gov](http://www.westcoast.fisheries.noaa.gov)

On Wed, Apr 5, 2017 at 9:35 AM, Brown, Darren <darren\_brown@partner.nps.gov> wrote:  
Hi Rick,

Per our conversations, attached is the figure you requested for the Sustainable Access Project. The figure adds the lift station which was the subject of the project modification. Let us know if you need anything else.

Thanks!

Darren

---

**Darren Brown**

Transportation Planner

Golden Gate National Recreation Area

[415.561.4933](tel:415.561.4933)

This page intentionally left blank.



As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.